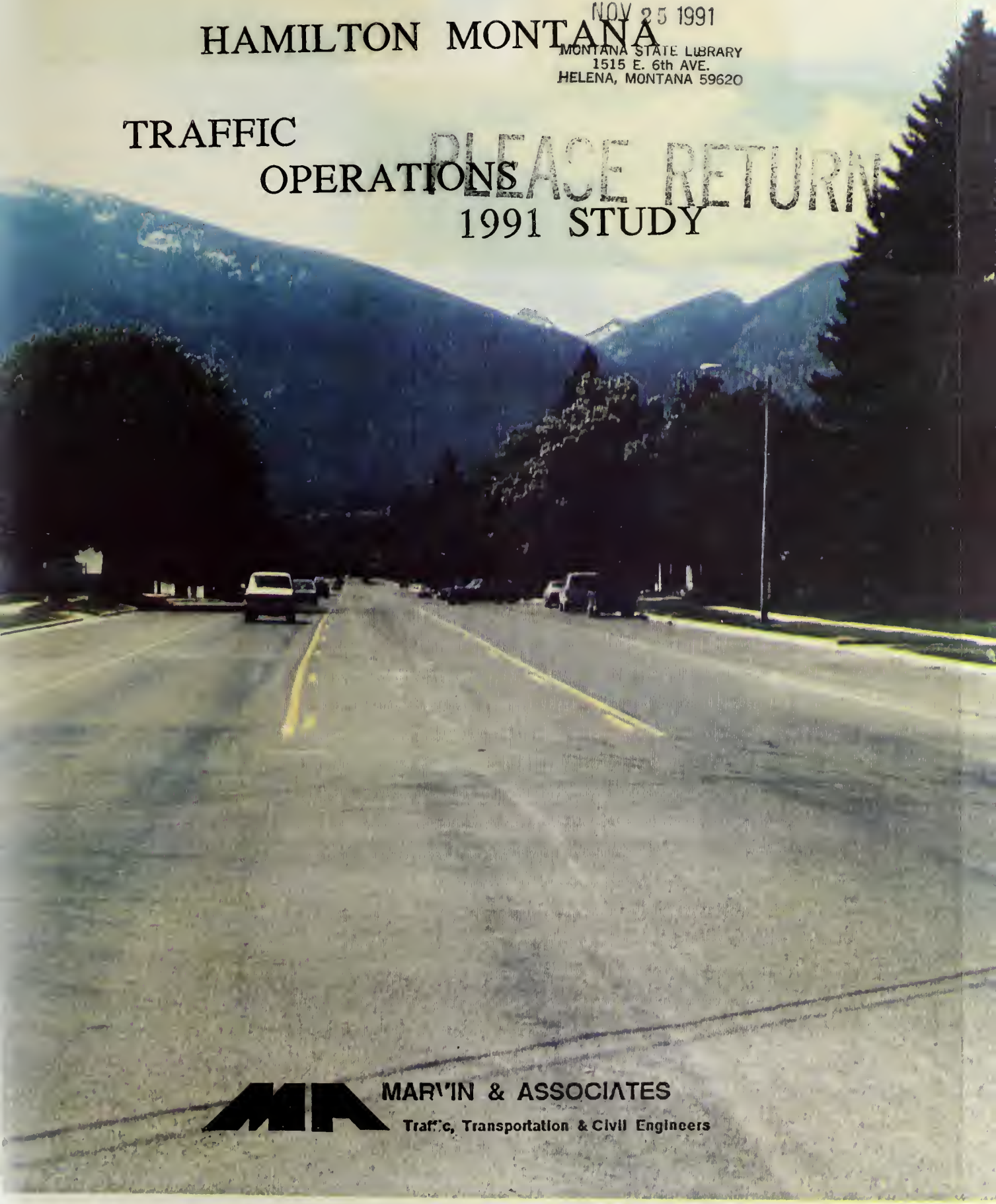
HAMILTON MONTANA

TRAFFIC OPERATIONS 1991 STUDY



MARVIN & ASSOCIATES
Traffic, Transportation & Civil Engineers

1991 HAMILTON

TRAFFIC OPERATIONS

STUDY

prepared for

CITY OF HAMILTON, MONTANA

In Cooperation With

MONTANA DEPARTMENT OF JUSTICE

HIGHWAY TRAFFIC SAFETY SECTION

prepared by

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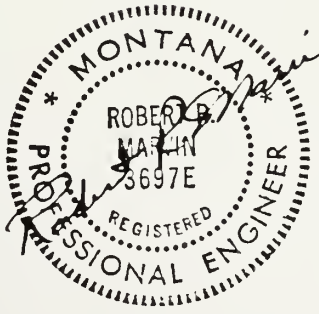

August 1991

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I. INTRODUCTION

In the past, the City of Hamilton had relied on the Montana Department of Highways and the Department of justice to assist them when traffic problems became evident. Recently, several problems were brought to the attention of Harry Lauer, Supervisor of the Highway Traffic Safety Section, Montana Department of Justice. During the course of his investigation, City officials requested that a coordinated study be completed of the entire town to avoid the patch work approach used in the past. At that time Highway Traffic Safety was completing a study of the US 93 Corridor from Missoula to Hamilton. That study focused on a serious accident problem involving the aged driver. Because the population of people over the age of 65 is more than twice the national average in Hamilton, it was recommended that further evaluation of the problem would be needed in that community. Since the City's request for a coordinated study of traffic operations was relevant to the aged driver problem, it provided a vehicle to advance Highway Traffic Safety's initial efforts. Because the state's manpower is limited, the study was to be completed by a consulting engineering firm through a proposal selection process. Marvin & Associates was retained by the City of Hamilton, through this process, and the study was funded by the Department of Justice.

The project, as it evolved, was completed with several objectives described in the following section.

A. STUDY OBJECTIVES

Objective #1 - To provide a data base describing and classifying the existing Hamilton street system for use in completion of the study and for future evaluations of traffic and transportation problems or issues that may arise.

Objective #2 - To define and qualify traffic and transportation problems associated with the existing street system (whether factual or perceived) through local input and engineering analysis.

Objective #3 - To provide solutions that could be implemented by the City of Hamilton which would increase the overall safety and efficiency

of the existing street system while complying with Federal, State and Local Laws and Ordinances and accepted standards of traffic control devices. Special emphasis toward aiding the aged driver would be applied wherever practical.

Objective #4 - To provide an acceptable traffic plan which would establish criteria for the City of Hamilton to use for future application of traffic control devices.

This study was performed by collecting an extensive amount of data, performing various types of engineering analysis and evaluating solutions based on the above noted objectives. Material contained in this report is a summary of conclusions drawn from the study process. Because of the extensive volume of material produced in this study, additional data and calculations supporting the conclusions are contained in a separate report titled "1991 Hamilton Traffic Operations Study - Technical Appendix"

B. DATA COLLECTION

The Montana Department of Highways provided a significant amount of traffic volume information, past school and signal study reports, as-built drawings and planned project drawings that were used in preparation of the study's data base. Because of the wealth of traffic volume information, very specific traffic volume variations and growth factors were established. Traffic data at locations not covered by MDOH data were generated by hour long turning movement counts at appropriate times of the day. In this manner, Average Daily Traffic (ADT) volumes were estimated for every street segment in the city. While this method does not have the same degree of precision as 48 hour counts taken with recording counters, it does provide a reasonably accurate depiction of traffic flow on the entire street system within the budget allotted for the study.

Every accident report filed within the city limits for a four year period was copied from Department of Justice files in Helena. Each report was assessed for specific location and categorized by intersection and street corridor. Statistical information pertinent to the aspects of this study were extracted from the reports and utilized in various ways within the study process.

A sign inventory of the entire city was completed by Pinnacle Engineering as a part of this study. Specific site problems were evaluated with respect to existing signing within this study. The inventory was also used to evaluate consistency of application and general inadequacies and needs.

Every street segment within the city was video taped with a vehicle mounted camera, while initial observations on physical condition and traffic operations were noted. This video recording along with 35 mm color photos of various street and traffic conditions provide a permanent record of the street system. They will be provided to the city for their use in review and for future reference. In addition, a 1989 aerial photo on reproducible mylar of Hamilton was obtained from MDOH for use in developing an updated base map of the street system and in determining land uses.

Spot speed zone studies were taken with radar equipment at some of the school crossing sites that were of local concern. Standard spot speed recording procedures were used whenever practical. This information along with school pedestrian counts were used in the analysis of school crossing protection.

Operation observations were made at select locations to provide a better understanding of driver behavior, physical conditions, roadside culture and possible problem conditions. In addition, numerous trial trips on street corridors were made to evaluate running speeds, conflicts, expectancy violations and other factors affecting traffic operations. Several trips were made on foot to note problems from a pedestrians' viewpoint.

C. LOCAL INPUT

A meeting at the outset of the study was attended by the consultant and local officials and police personnel. Objectives and methods of the study were discussed and local concerns were aired. A list of specific sites and perceived problems was given to the consultant so that they could be addressed within the course of the study. Subsequent to that meeting, generalized data for the entire city was evaluated and it appeared that almost 90% of the locations suggested by the local government would have surfaced as a problem area within the framework of the study's problem identification process.

A draft of this report was made available to the City of Hamilton and the Highway Traffic Safety Section and the results were presented by the consultant at a subsequent meeting held on July 24, 1991 in Hamilton. With the exception of some minor modifications, the study results were well received. A positive attitude toward implementation of the proposed recommendation was expressed.

D. ANALYSIS METHODS

Several different analysis techniques were used at various points within this study. Generalized methods of estimating ADT were used to develop accident rates in the accident site screening process. A simplified method of combining number of accidents, accident severity and accident rate was used to calculate an accident index. Statistical methods were used to determine a significant number of intersections considered hazardous.

Capacity calculations were performed at locations where efficiency was considered suspect or where traffic control devices may have been outdated by changes in traffic patterns. The HCS Ver. 1.5 and 2.0 computer software written by FHWA was used to perform all capacity calculations.

All signal and traffic control device warrant analysis was performed according to the Manual of Uniform Traffic Control Devices (MUTCD). Estimates of traffic volumes for hours other than peak hours actually counted, were factored from the volume variations determined by analysis of MDOH automatic machine counters.

Cost analysis was based on two different sources. For signing and safety improvements, costs contained on the list of eligible items for MDOH Off-system Safety Funds were used. For estimating costs of other items the latest MDOH unit bid tabulations sheets were used. The cost analysis presented within this report may not accurately reflect actual costs that may be incurred by the City of Hamilton, if they choose to perform the work themselves.

All other analysis procedures utilized in the study were in conformance with accepted traffic engineering, statistical and design practises.

E. BASIS OF RECOMMENDATIONS

Recommendations for traffic control devices contained within this report are based on standards practises and legal requirements of the Montana Motor Vehicle Code and the Manual of Uniform Traffic Control Devices. In the case of traffic control device as applied to accident reduction or improved system efficiency, objective decisions based on interpretation of data and analysis by an experienced traffic engineering professional was used.

In many cases, professional engineering judgement was necessary to determine possible cause and effect relationships. The resultant recommendations are based somewhat on the informed opinions and experience of the traffic engineer. In these cases, an explanation of the reasoning behind these recommendations are presented within this report.

Many recommendations require a policy decision by the local governing body. This report attempts to present the necessary facts and consequences of each option to assist the City of Hamilton in making their decision.

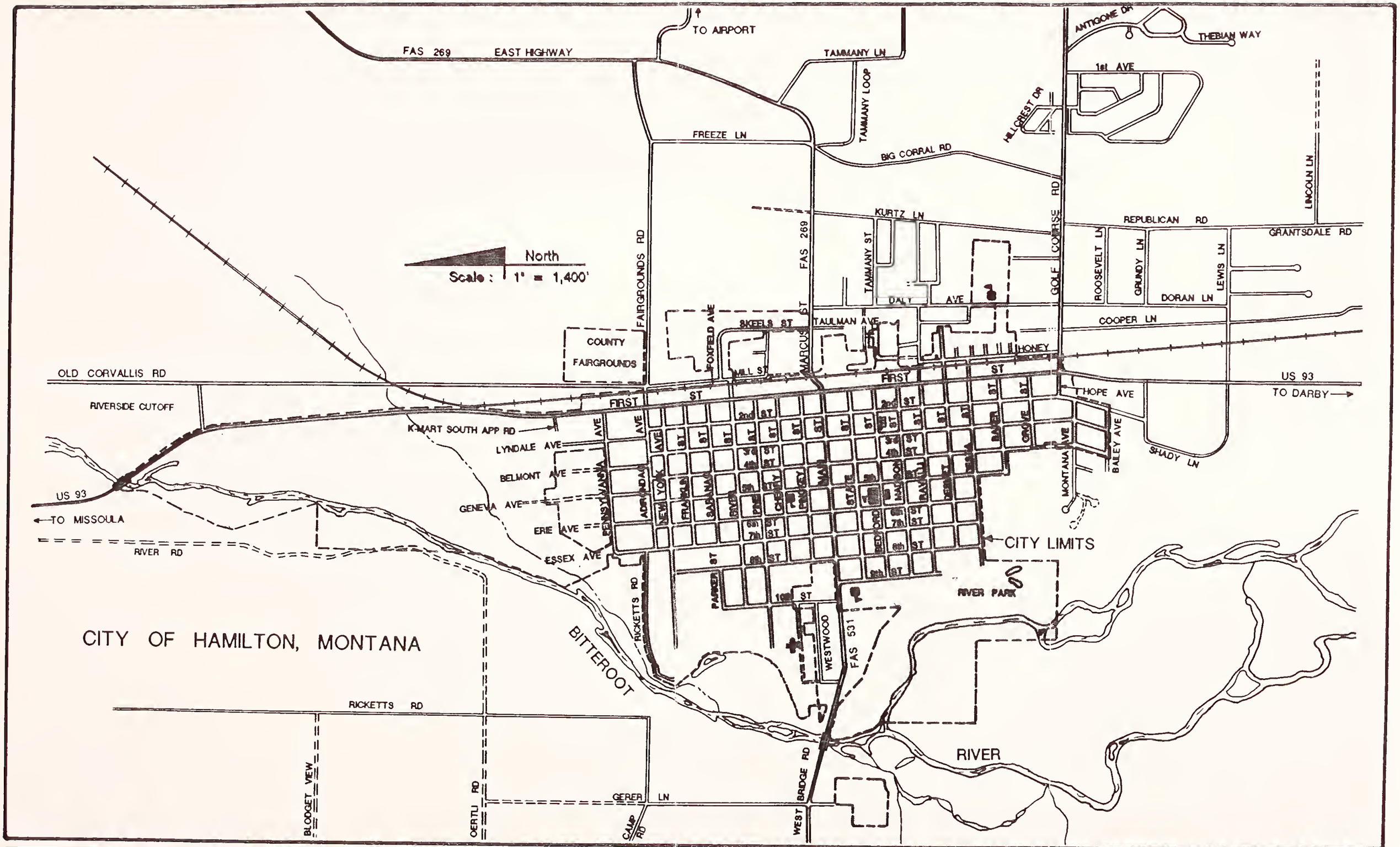
II. EXISTING CONDITIONS

The description of existing conditions in this section of the report deals primarily with traffic conditions relative to the street system layout, geometry, traffic volumes, roadside culture, traffic control devices and accident experience from a historical perspective.

A. STREET SYSTEM & LAND USE DESCRIPTION

The City of Hamilton is situated east of the Bitteroot River and is bisected by US Highway 93 (see Figure 1.). The majority of land area within the city limits is located on the west side of US 93, which is known as First Street within the city proper. The town site west of US 93 is laid out on a grid pattern with uniform block dimensions and 80 foot street rights-of-way. North-south streets have a number designation while east-west streets are named. The area on the east side of US 93 is occupied primarily by railroad right-of-way within the city limits. Areas of substantial residential development exists east of the railroad tracks beyond the city limits. Streets in this area were not planned to fulfill any organized function other than to provide immediate access. There are only four major access points to US 93 from the east: Riverside Cutoff to Old Corvallis Road, Fairgrounds Road, Marcus Street (FAS 269) to the Eastside Highway, and Golf Course Road. These four access roads carry the majority of traffic between the east and west sides of Hamilton and all involve a railroad crossing.

Main Street (FAS 531) is the only city street that traverses the city in an east-west direction. It becomes the Eastside Highway, east of town, and crosses the Bitteroot River to access areas west of town. In earlier years, the Hamilton business district was confined exclusively to an area along Main Street. This area, commonly known in most cities as the Central Business District (CBD), is located west of US 93, south of Cherry Street and north of Madison. It contains the normal mix of specialty shops, service businesses, offices, and municipal buildings. The CBD remains vital to the economy of the city. However, in the past 10 to 15 years, increasing strip development along US 93 to the north has occurred. New supermarkets, fast food restaurants and large major retailers have located along US 93, which has shifted traffic patterns and provided impetus for additional development.



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CITY OF HAMILTON
TRAFFIC OPERATIONS STUDY

FIGURE II-1.
HAMILTON STREET SYSTEM

B. AVERAGE DAILY TRAFFIC

Basic to the development of a traffic operations study is establishment of Average Daily Traffic Volumes (ADT) on the street system. The Montana Department of Highways provided a significant amount of current and historical traffic volume data from which the study expanded to include all of the street segments within the city limits. A significant number of additional traffic counts were taken on the city street system and adjusted to determine ADT. Table II-1. is a summary of all ADT volumes on significant segments of the city street system in 1991. Included in the summary is an estimate of the average ADT during the last four year period and an estimate of year 2000 ADT based on a linear projection of historic traffic growth. The year 2000 estimate should not be interpreted in the same way as a transportation plan projection. Many factors could enter the system to change historical traffic growth patterns which could change these estimates significantly.

Figure II-2. illustrates the traffic flow patterns on the city street system based on the ADT volumes noted in Table II-1. This illustration serves to identify the existing streets which carry the most significant traffic volumes and it provides a relative perspective on the balance of traffic on the street system. It also serves as a quick reference when approximate ADT volumes on individual streets are desired.

TABLE II-1. SUMMARY OF AVERAGE DAILY TRAFFIC (ADT) HAMILTON STREETS

STREET NAME	SECTION FROM	SECTION TO	1991 ADT	LAST 4 YR AVERAGE	YR 2000 ESTIMATE
US 93	CITY LIMITS	RIVERSIDE CUTOF	7,300	6,747	10,480
US 93	RIVERSIDE CUTOFF	SOUTH	7,852	7,375	11,272
FIRST STREET (US 93)	ADIRONDAC	NORTH	13,666	12,732	19,620
FIRST STREET (US 93)	ADIRONDAC	PINE	14,656	12,744	28,099
FIRST STREET (US 93)	PINE	PINCKNEY	14,500	12,609	27,800
FIRST STREET (US 93)	PINCKNEY	MAIN	14,768	12,675	21,202
FIRST STREET (US 93)	MAIN	STATE	13,525	11,900	20,448
FIRST STREET (US 93)	STATE	GROVE	13,209	11,700	19,971
FIRST STREET (US 93)	GROVE	GOLF COURSE R	10,115	9,246	15,293
US 93	GOLF COURSE RD	SOUTH	7,424	6,593	12,866
MAIN STREET	FIRST	SECOND	8,389	6,343	11,940
MAIN STREET	SECOND	THIRD	5,137	4,757	7,312
MAIN STREET	THIRD	FOURTH	3,763	3,484	5,356
MAIN STREET	FOURTH	NINTH	2,820	2,260	4,014
MAIN STREET	NINTH	TENTH	3,221	2,982	4,584
MAIN STREET	TENTH	WEST	3,382	3,131	4,814
RIVERSIDE CUTOFF	US 93	OLD CORVALLIS	1,146	1,059	1,645
SKEELS STREET	MARCUS ST	NORTH	362	335	515
MARCUS STREET	FIRST	DALY	3,644	2,483	5,186
MARCUS STREET	DALY	EAST	2,424	2,483	3,450
FAIRGROUNDS RD	FIRST	OLD CORVALLIS	2,800	2,588	4,020
FAIRGROUNDS RD	OLD CORVALIS	EAST	2,134	1,972	3,063
ADIRONDAC STREET	FIRST	SECOND	1,979	1,829	2,842
ADIRONDAC STREET	SECOND	SEVENTH	842	778	1,209
OLD CORVALLIS RD	FAIRGROUNDS	NORTH	1,716	1,586	2,464
MILL STREET	FAIRGROUNDS	SOUTH	406	376	578
HONEY STREET	RAVALLI	GOLF COURSE R	600	577	717
GOLF COURSE RD	FIRST	DALY	3,879	3,546	5,865
GOLF COURSE RD	DALY	EAST	2,874	2,627	4,345
HOPE AVENUE	FIRST	WEST	668	610	1,010
DALY AVENUE	MARCUS	GOLF COURSE R	721	694	862
SECOND STREET	ADIRONDAC	CHERRY	1,136	1,093	1,358
SECOND STREET	CHERRY	PINCKNEY	1,591	1,473	2,264
SECOND STREET	PINCKNEY	MAIN	2,746	2,542	3,908

TABLE II-1. cont.

SECOND STREET	MAIN	STATE	3,232	2,993	4,601
SECOND STREET	STATE	BEDFORD	1,428	1,322	2,032
SECOND STREET	BEDFORD	MADISON	800	780	900
SECOND STREET	MADISON	HOPE	700	673	837
THIRD STREET	ADIRONDAC	CHERRY	600	577	717
THIRD STREET	CHERRY	PINCKNEY	1,557	1,497	1,861
THIRD STREET	PINCKNEY	MAIN	2,106	1,950	2,997
THIRD STREET	MAIN	STATE	2,423	2,243	3,448
THIRD STREET	STATE	BEDFORD	913	845	1,299
THIRD STREET	BEDFORD	MADISON	1,321	1,223	1,881
THIRD STREET	MADISON	GROVE	633	608	756
FOURTH STREET	ADIRONDAC	PINCKNEY	1,330	1,279	1,590
FOURTH STREET	PINCKNEY	MAIN	2,367	2,191	3,368
FOURTH STREET	MAIN	STATE	1,361	1,260	1,938
FOURTH STREET	STATE	GROVE	1,285	1,236	1,536
FIFTH STREET	ADIRONDAC	MAIN	440	423	526
FIFTH STREET	MAIN	BAKER	412	396	493
SIXTH STREET	ADIRONDAC	MAIN	300	288	359
SIXTH STREET	MAIN	DESTA	300	288	359
SEVENTH STREET	PENNSLYVANNIA	ADIRONDAC	450	433	538
SEVENTH STREET	ADIROPNDAC	MAIN	654	629	781
SEVENTH STREET	MAIN	DESTA	665	640	795
EIGHT STREET	NEW YORK	MAIN	300	288	359
EIGHT STREET	MAIN	DESTA	300	300	300
NINTH STREET	MAIN	STATE	656	607	933
NINTH STREET	STATE	RAVALLI	253	234	360
TENTH STREET	PARKER	PINE	669	620	952
TENTH STREET	PINE	MAIN	1,460	1,352	2,078
PENNSYLVANNIA ST	FIRST	ESSEX	368	354	440
NEW YORK STREET	FIRST	EIGHT	500	481	598
FRANKLIN STREET	FIRST	SEVENTH	400	385	478
SARANAC STREET	FIRST	SEVENTH	500	481	598
RIVER STREET	FIRST	MILL	300	288	359
RIVER STREET	FIRST	TENTH	487	468	582
PINE STREET	FIRST	THIRD	1,658	1,535	2,360
PINE STREET	THIRD	TENTH	1,019	943	1,450
CHERRY STREET	FIRST	THIRD	300	300	300

TABLE II-1. cont.

CHERRY STREET	THIRD	EIGHT	243	233	290
PINCKNEY STREET	FIRST	SECOND	1,768	1,700	2,113
PINCKNEY STREET	SECOND	THIRD	1,818	1,748	2,173
PINCKNEY STREET	THIRD	FOURTH	1,431	1,376	1,710
PINCKNEY STREET	FOURTH	EIGHT	500	481	598
STATE STREET	FIRST	SECOND	3,541	3,279	5,041
STATE STREET	SECOND	THIRD	3,457	3,201	4,921
STATE STREET	THIRD	FOURTH	2,906	2,690	4,136
STATE STREET	FOURTH	FIFTH	2,258	2,091	3,214
STATE STREET	FOURTH	NINTH	706	654	1,005
BEDFORD STREET	FIRST	SECOND	657	608	935
BEDFORD STREET	SECOND	THIRD	700	700	700
BEDFORD STREET	THIRD	NINTH	533	513	637
MADISON STREET	FIRST	SECOND	1,050	1,050	1,050
MADISON STREET	SECOND	THIRD	998	959	1,192
MADISON STREET	THIRD	NINTH	467	449	558
RAVALLI STREET	FIRST	DALY	1,193	1,104	1,698
RAVALLI STREET	FIRST	NINTH	914	847	1,302
DESMET STREET	FIRST	HONEY	300	294	328
DESMET STREET	FIRST	EIGHT	400	385	478
DESTA STREET	FIRST	HONEY	400	385	478
DESTA STREET	FIRST	EIGHT	500	481	598
BAKER STREET	FIRST	FIFTH	200	196	219
GROVE STREET	FIRST	FIFTH	200	196	219
MONTANA AVE	SECOND	WEST	200	196	219
LYNDALE AVENUE	ADIRONDAC	PENNSYLVANNIA	200	196	219
LYNDALE AVENUE	PENNSYLVANNIA	NORTH	100	98	109
BELMONT AVENUE	ADIRONDAC	PENNSYLVANNIA	200	196	219
BELMONT AVENUE	PENNSYLVANNIA	NORTH	100	98	109

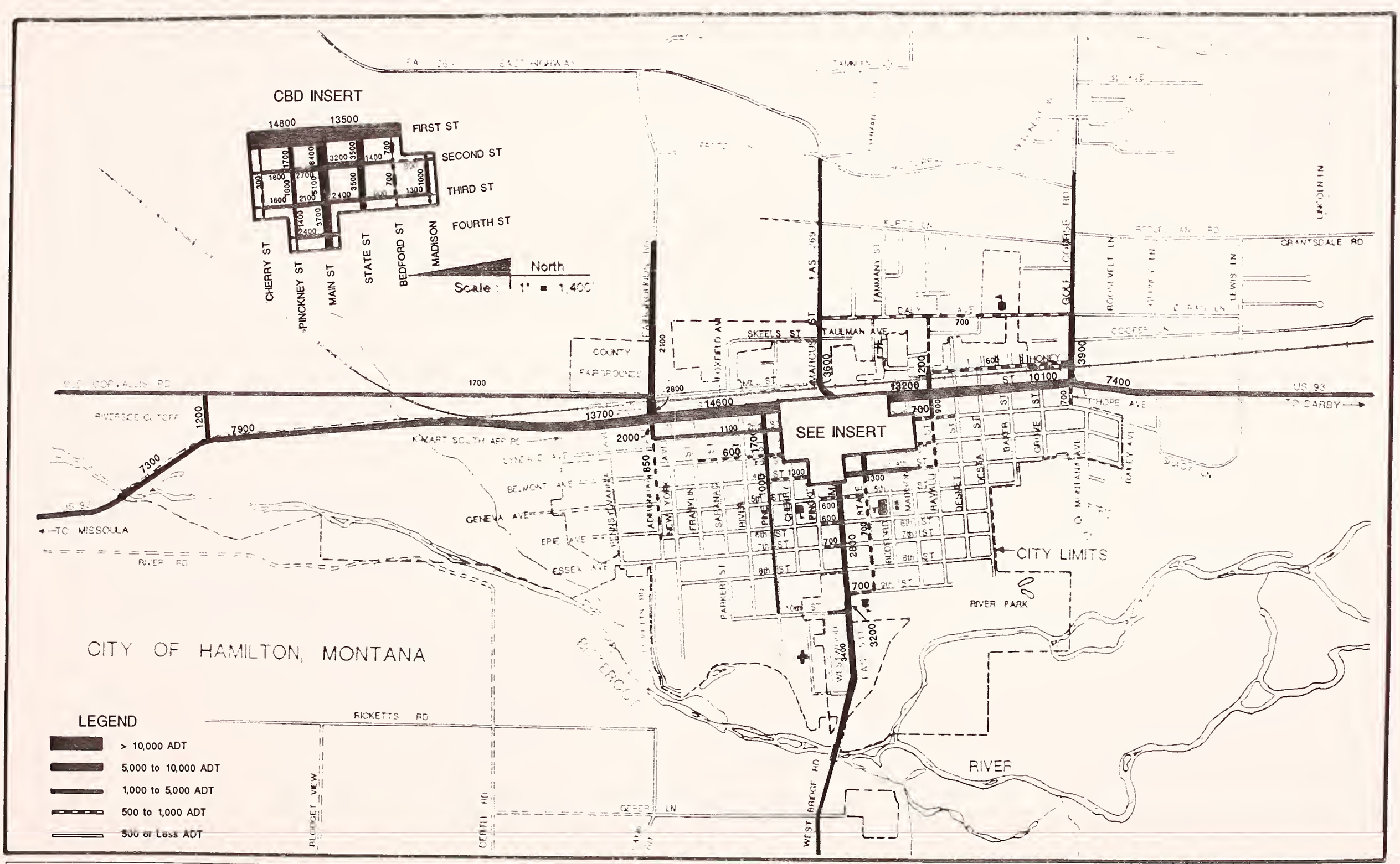

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FIGURE II-2.
EXISTING TRAFFIC - ADT

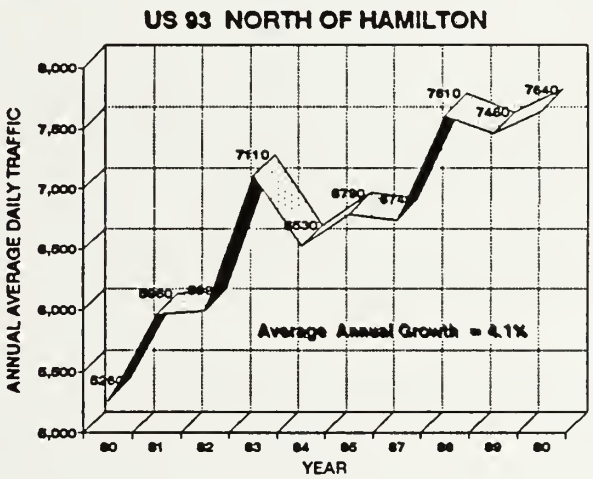
C. TRAFFIC CHARACTERISTICS

The following sections describe the historic traffic volumes on significant city streets as well as monthly, daily and hourly traffic volumes. Traffic characteristics are important in estimating ADT and in predicting design hour volumes from average daily traffic. An ADT can be converted to any one hour volume for any given day in the year by applying the appropriate variation factors.

1. HISTORIC VOLUMES

Years of traffic counts vary depending on the location within the Hamilton street system. MDOH usually confines detailed counts to those locations on the state primary and secondary system. The count data is so detailed and comprehensive that the data provides a good representation of the entire city system.

Figure II.3., at right, represents the growth trend on US Highway 93 from 1980 to 1990. One location is just north of Hamilton's city limits and the other is just south of the city limits.



These volumes generally represent the volume of traffic external to the city and is composed of thru traffic and traffic with an origin or a destination in Hamilton. While it would require a specialized study to state the degree of thru traffic accurately, it is estimated that approximately 20 % of the ADT is thru traffic.

The approximate average annual ADT growth on US 93 is 5.2%.

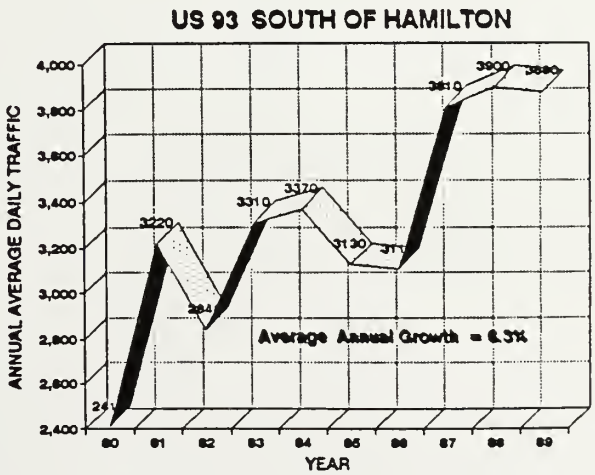
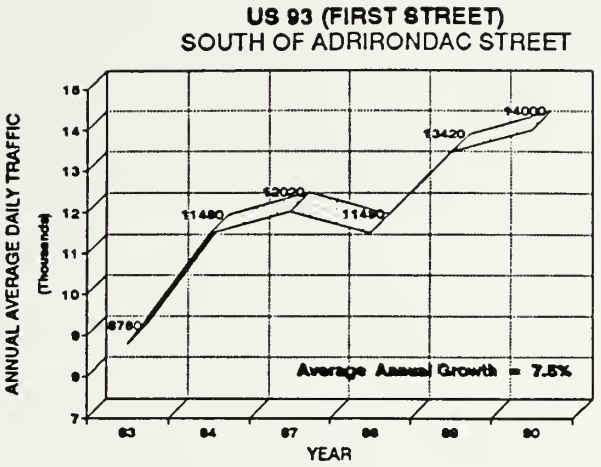
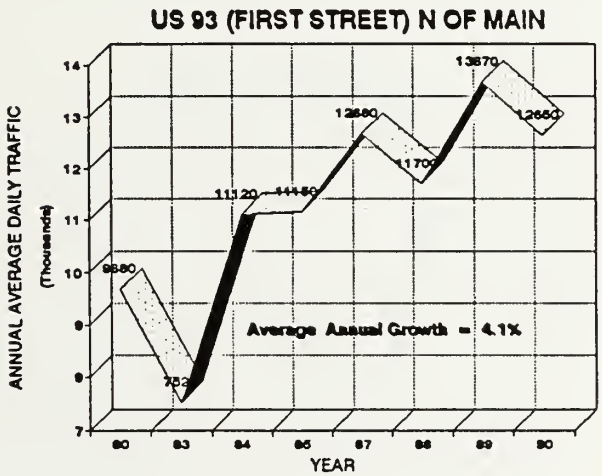


Figure II.4., on the right, shows the historic trends on US 93 (First Street) within the city limits of Hamilton. The three locations are near major intersections with US 93.

US 93 south of Adirondac has the highest growth rate of the three and mirrors the construction of strip, commercial development along US 93 on the north end of the city. The annual growth rate of 7.5% is greater than that experienced on US 93 outside the city limits and at the other two locations within the city, which indicates a higher level of traffic generated within the city destined to the new commercial areas.

All of these locations indicate periods of highs and lows, but the overall trend is definitely upward. Increasing volumes on US 93 shows the dependance on this route as a major arterial to accommodate transportation within the valley and in the City of Hamilton. Any increase in the valley's population ultimately turns up as increased traffic on US 93.





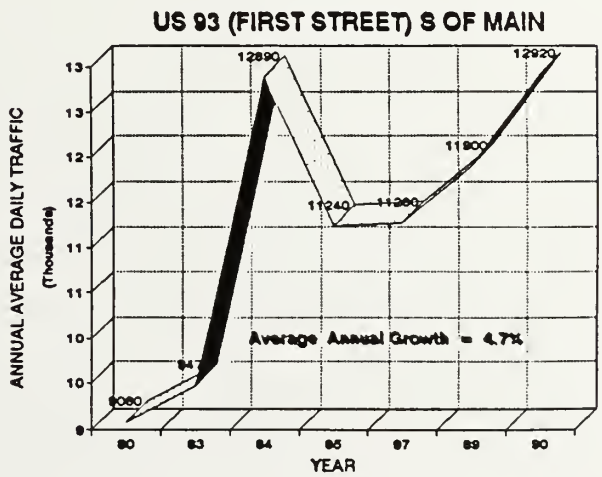
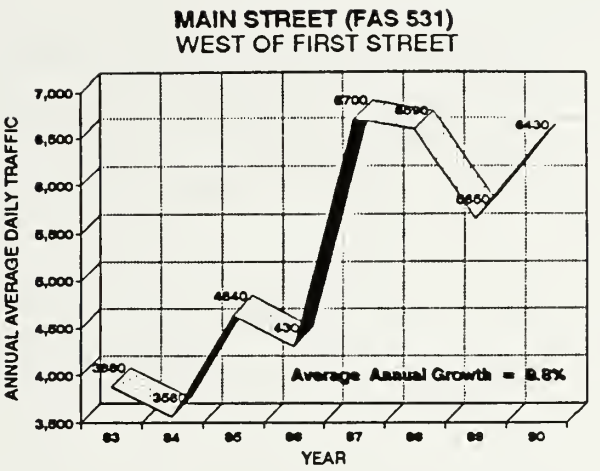


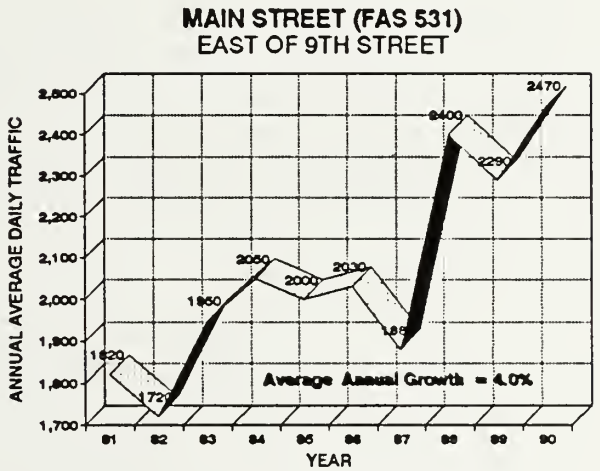
Figure II-5., on the right, is the graphic plots of historic ADT's on the major east-west route through Hamilton.

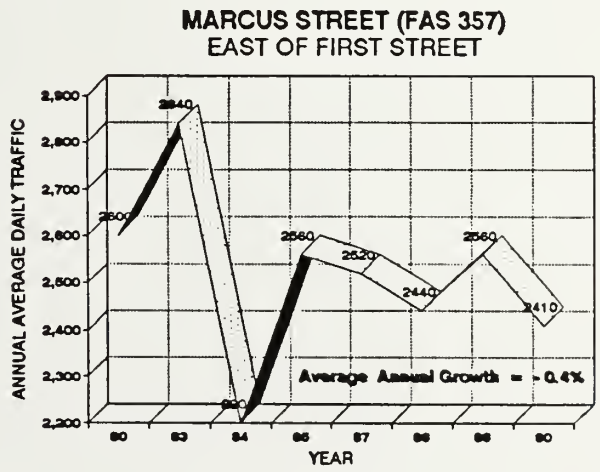
Main Street west of US 93 (First Street) has the highest recorded traffic growth within the City of Hamilton. It is in fact, higher than on US 93 in the new commercial area and is double the average growth rate of other city streets. Counts taken as a part of this study, confirm this trend.

Main Street west of 9th has a growth rate consistent with other city streets and illustrates the level of population increase in areas west of the river and at new developments near 10th & Pine.

Marcus Street is the only street that has an uncharacteristic decrease in traffic volumes. The apparent reason for this trend is probably because of improvements to access at Adirondac and Golf Course Road while the Marcus St. approach to US 93 is limited in capacity and is difficult to drive because of difficult geometry, a rough road surface and traffic conflicts.





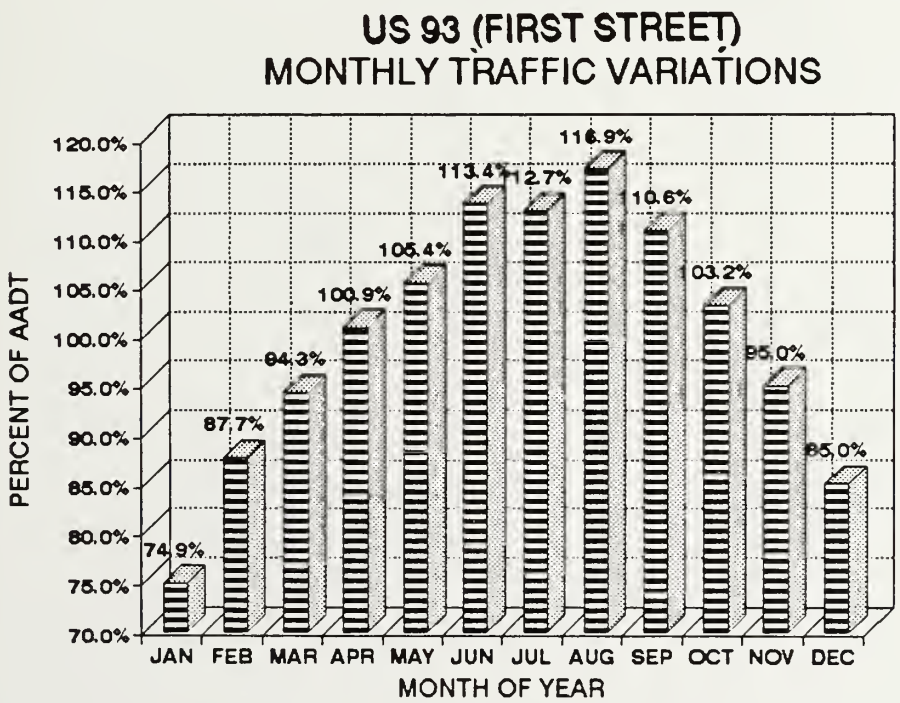


2. MONTHLY VARIATIONS

The Montana Department of Highways maintains a permanent count station on US 93 (First Street) near its intersection with Adirondac. The count station transmits continuous traffic data every hour of every day. Because of this intense level of data acquisition, traffic volumes variation can be calculated very precisely.

Traffic records from this count station are summarized by month for every year of record. When the average daily traffic is computed for the year, the ADT for each particular month can be converted to a percentage of the annual average daily traffic (AADT).

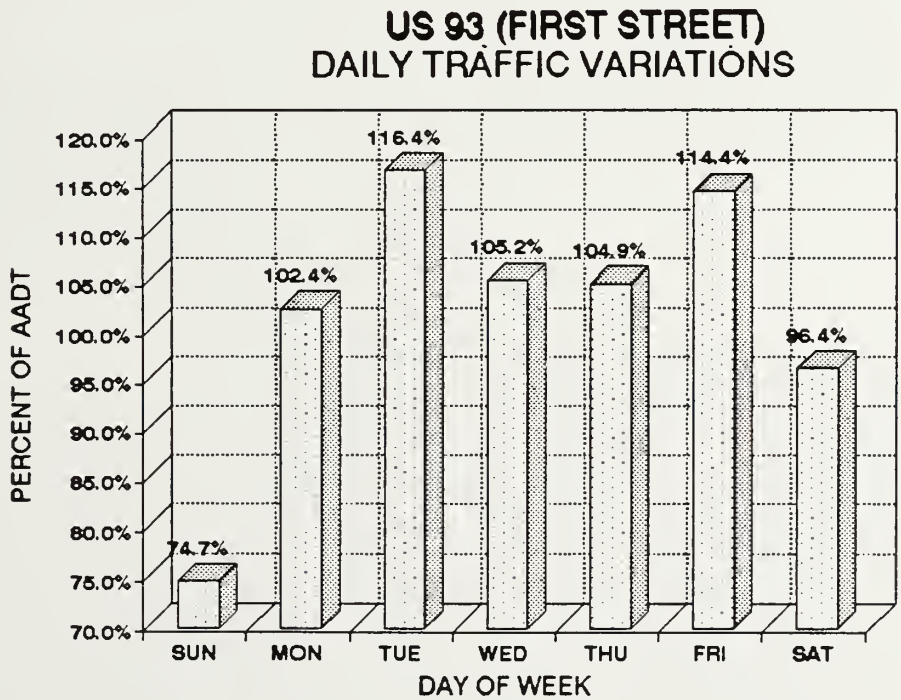
Figure II-6., below, is a graphic illustration of the monthly AADT variation. The lowest traffic month in Hamilton is January, with only 74.9% of AADT. August is the highest traffic month with 116.9% of AADT. These extremes are somewhat greater than most communities in Montana. The reason for this may be due, in part, to the large number of aged drivers in the area combined with weather and road conditions.



3. DAILY VARIATIONS

The MDOH permanent count station on US 93 (First Street) also sums traffic on a daily basis. While daily traffic may vary somewhat from week to week and month to month, the statistical average of each day provides a precise measure of the variation in traffic between days of the week.

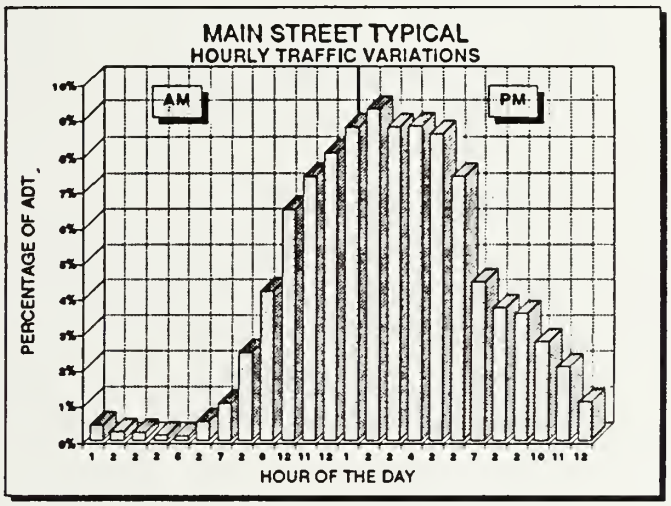
Figure II-7., below, illustrates the variation in traffic between days of the week. Sunday is the lowest traffic day with only 74.7 % of average daily traffic while Tuesday is the highest with a 116.4% of ADT. In most communities, Friday is normally the highest traffic day followed by Monday. The reason why Tuesday is the peak traffic day in Hamilton is not readily apparent, but it would have to be related to some aspect of the local economy.



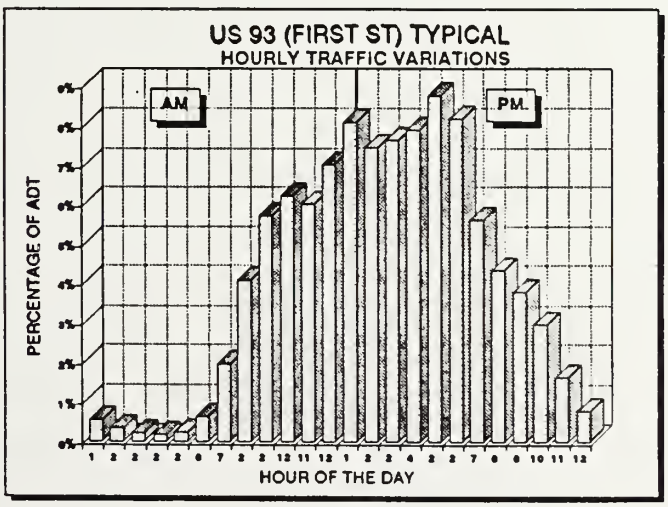
4. HOURLY VARIATIONS

The variation in traffic volumes based on the hour of the day is usually the most consistent of all traffic characteristics on any given street. However, hourly variations can have a wide range of differences from one type of street to the next. Commercial areas or central business district streets will not normally have significant peaks during the day while an arterial that carries a significant volume of commuter vehicles will have extreme peaks in the morning and evening (see Technical Appendix for specific streets).

Figure II-8., on the right, illustrates the hourly variations in traffic volumes on two streets in Hamilton. Each hour of the day is represented by a bar indicating percent of total daily traffic counted within that hour.



The Main Street graph shows traffic increasing significantly from 7 AM to 10 AM, then increasing at a slower rate until 5 PM, when it reaches a peak of 8.5% of ADT.



The US 93 graph is somewhat similar to Main Street except the peak is reached at 2 PM, which is very unusual for this type of street. Three distinct peaks (AM, Noon & PM) should appear with this type of street. The lack of commuter peaks could be due to the large number of retired people in the area.

D. TRAFFIC CAPACITY

Traffic capacity as applied to streets and intersections is a highly complex concept that is rarely understood by the average person. Capacity is only meaningful when expressed in terms of a facilities "Level of Service" (LOS). LOS is a qualitative term used to describe certain traffic conditions on a facility which affect drivers' perceptions of convenience. At intersections, LOS is measured by perceived or stopped delay, while on continuous sections of roadway it is measured by speed or travel time. In urban areas, it is difficult to separate the two methods of measurement unless roadway sections are signed as a through route for a significant distance. Even then, turning vehicles and roadside friction from side streets degrade the LOS and computation of capacities must reflect these conditions. Within this study, capacities were calculated on an individual intersection basis. Capacity of roadway sections, stated herein, are based on an average for intersections along the street under consideration.

Level of Service (LOS) designations start at LOS "A", which is a free flow condition, travel speeds are at or near maximum design speed. There is no delay and no interruptions. LOS range downward through letter designation from "A" to "F". LOS "F" describes complete and utter congestion with no perceptible vehicular movements. The mid range LOS "C" would be described as a condition where relatively stable traffic flow movements exist at comfortable speeds. Delay is tolerable and occasional interruptions are encountered.

In this report, whenever a traffic volume is designated as the capacity of a particular street, it should be understood that it is the capacity of that street at level of service (LOS) "C". LOS "C" is the standard adopted for most streets and highways as the Design LOS. However, in larger cities where delay is a common condition, a lesser LOS "D" can be adopted as a design level.

Typical street section capacities (LOS "C") in Hamilton are generally within the following ranges:

Two Lane Streets with Parallel Parking	7,000 - 9,000 ADT
Two Lane Streets with Angle Parking	5,500 - 7,200 ADT
Three Lane Streets (center left turn)	11,000 - 13,000 ADT
Four Lane Streets w/ Parallel Parking	15,500 - 18,000 ADT
Five Lane Streets (center left turn)	26,000 - 30,000 ADT

E. TRAFFIC CONTROL DEVICES

Hamilton, like many communities in Montana, has a mixture of old, new and non-standard signing. US 93 has the most consistent array of traffic control devices because MDOH reconstructed the entire street segment approximately five years ago. The remainder of the street system has a variety of problems and inconsistencies that are discussed within the operational observations section of this report.

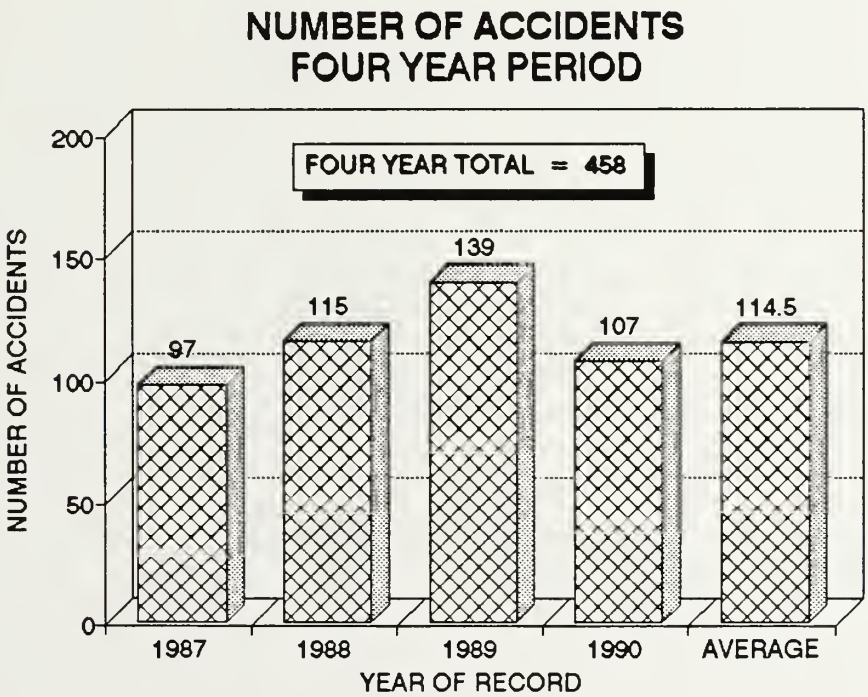
All traffic control devices on state highways and city streets are bound by law to conform to the Manual on Uniform Traffic Control Devices (MUTCD). Any variation from these standards can sometimes expose governmental bodies to disastrous litigation. When a community such as Hamilton experiences rapid growth, traffic control devices can become antiquated and attempts to control problems as they occur, results in non conforming installations. Lack of funds to upgrade the system also contributes to the problem. Implementation of the specific and general recommendations within this report will aid the City in their efforts to standardize traffic control devices city wide.

F. ACCIDENT STATISTICS

There were approximately 500 accidents reported within the Hamilton city limits in the four year reporting period between January 1987 and December 1990. All of the accidents on file with the State of Montana were copied and carefully sorted based on location. Approximately 5% of the reports had to be discarded because of missing information which defied various attempts at determining even an approximate location. The verified reports were then assessed for information pertinent to the study analysis. Pertinent statistical information on all accidents in Hamilton were compiled and are summarized in the following sections.

1. ANNUAL DISTRIBUTION

Figure II-9., below, shows the number of accidents in each of the four years in the reporting period. The lowest year of record was 1987, with 97 accidents and 1989 was the highest with 139. Average for the four years was 114.5 accidents per year. It appears that there was an upward trend with a reduction in 1990, but the variations are not statistically significant.

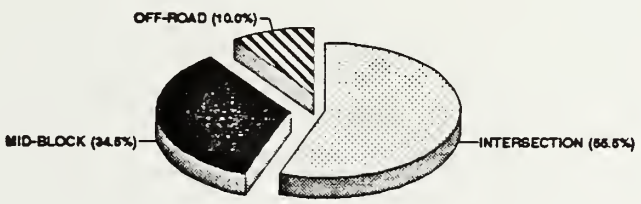


2. ACCIDENT LOCATION & TYPES

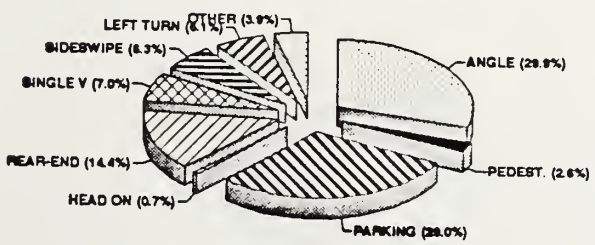
Figure II-10., below, indicates the typical location of accidents and the type of accidents that have occurred. The majority of accidents have occurred at intersections (55.5%) while 34.5% of the accidents occurred at midblock locations. Only 10% of the accidents occurred off the street system, in alleys, parking lots, etc.. The intersection to non-intersection accident ratio is somewhat low compared to other urban areas. This is probably due to the high incidence of mid-block parking accidents.

With regard to accident types, there is clearly a disproportionate percentage of parking accidents (29.0%). State wide, parking accidents account for less than 1% of all accidents. In urban areas, parkings accidents normally average less than 5% of all accidents. Angle accidents in Hamilton accounted for 29.9% of the total, while normal urban areas experience between 45% and 60%. The low percentage in this and other categories are due to the large number of parking accidents.

TYPICAL ACCIDENT LOCATIONS
PERCENT OF ALL ACCIDENTS



TYPE OF ACCIDENTS
PERCENT OF ALL ACCIDENTS



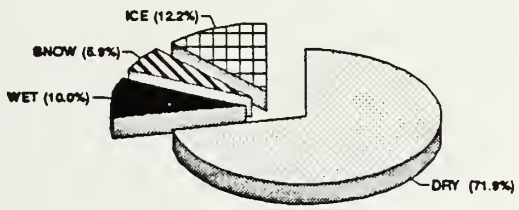
3. ACCIDENT SEVERITY

There were no fatal accidents recorded in the four year period. Injury accidents accounted for 20.3% of all accidents, while the remainder were property damage accidents. This ratio is well within a normal range for an urban area.

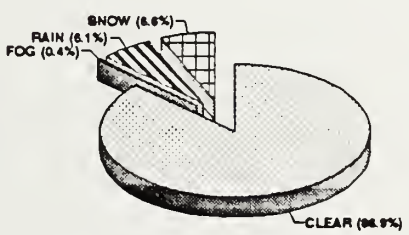
4. ROAD, WEATHER AND LIGHT CONDITIONS

Figure II-11., below, illustrates the road and weather conditions involved in the reported accidents. The majority of accidents occurred on dry roads (71.6%) and in clear weather (86.9%). The remainder happened in various combinations of rain, snow and ice. These statistics are very typical of urban type accidents.

ROAD CONDITIONS
PERCENT OF ALL ACCIDENTS



WEATHER CONDITIONS
PERCENT OF ALL ACCIDENTS



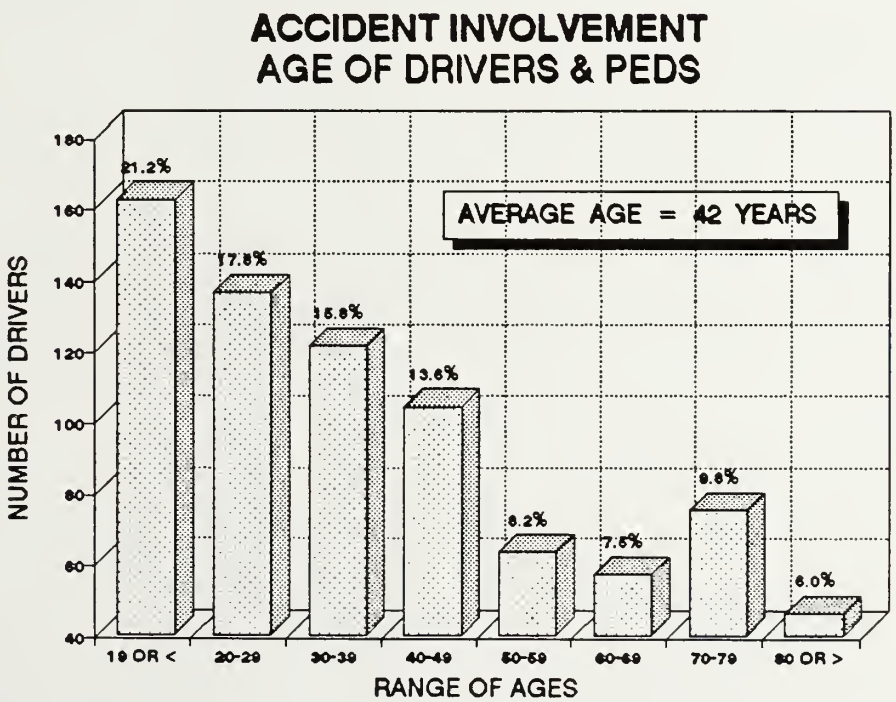
5. DRIVER INVOLVEMENT

Various aspects of driver behavior and status are popular statistics among traffic law enforcement agencies, since they make interesting headlines. Therefor, accident reports are replete with information on the drivers involved. Most of the information on driver involvement does not significantly aid traffic and transportation engineers in design or modification of street and highway facilities to improve safety. Government agencies report the high incidence of alcohol involvement in the number of fatalities, which is rather high because they normally include multiple fatalities per accident. Rarely do they publish statistics on the roll of alcohol in other accident types. In Hamilton, the percentage of all accidents which involved alcohol was 7.6%. This incidence is slightly lower than normal. Average involvement on county roads and city streets within Montana ranges from 10 to 20% of all accidents. Alcohol involvement with accidents in Hamilton should expected to be lower than normal, because of the large number of aged drivers, who tend to abstain from or moderate their consumption of alcohol.

Information on the alcohol related accident occurrence has traditionally triggered the wrong response from officials charged with insuring the safety of our streets and highways. When an intersection or section of roadway has significant accident experience and data indicates there were drivers under the influence, the tendency has been to dismiss any possibility of roadway dysfunction and the problem is blamed on the "drunks". This is not a rational decision, since our street and highway system is populated by drivers with a wide range of abilities and impairments. Design of street and highway systems must account for the worst driver and the most capable drivers will gain added safety.

The problems commonly associated with the aged driver, slow reaction times, decreased night vision, reduced peripheral vision, reduced hearing and slower decision making ability are also some of the symptoms suffered by the alcohol impaired driver. While none of our government agencies want to improve the safety of streets and highways to accommodate our "drunks", we are now faced with the monumental problem of improving our roads to accommodate our aging population. Since 39% of Hamilton's population is 60 or older (15% is national average), the accident statistics involving the aged driver is of particular interest.

Figure II-12., below, is a summary of the percentage accidents attributed to drivers in eight different age groups. The highest percentage (21.2%) is associated with drivers 19 years of age or below. Presumably the youngest would be 16, however drivers as young as 14 were noted. The percentages decrease as the age group increases as would be expected. Except the age group 70-79 years has a higher percentage (9.8%) than those in any of the groups above 50 years. Total involvement for persons over 60 years is 23.3% of all accidents. The ratio of accident involvement percentage to population percentage is 0.59 (23.3/39.0). Nationally the ratio is reported to be 0.81 (12.8/15.8). Thus, the involvement of people over 60 years of age in accidents is actually less in Hamilton than it is nationally when age composition of the population is taken into account. The reason for this may be that Hamilton is a smaller city with lower traffic volumes and less complex traffic systems. Also, there is a possibility that the aged driver in Hamilton composes a higher percentage of all traffic, and driver behavior is more homogeneous than in areas with younger drivers.



Other interesting trends were noted in the process of compiling accident statistics. The following are observations for which exact data may or may not be readily available, but the trends are important in the consideration of street system improvements:

* Older drivers (60 and up) tend to be involved in a higher percentage of accidents on multi lane arterial and collector streets than on local streets. Slower speeds, low traffic volumes and few decisions on local streets are more conducive to the older drivers abilities.

* Older drivers (60 and up) were only involved in 20% of parking accidents, which comprise a significant number of all accidents in Hamilton. Older drivers' slow and careful negotiation of the parking maneuver reduces their involvement in this type of accident, but reduces traffic flow efficiency.

* Less than 10% of all night time accidents involved drivers over the age of 65. This is probably due to the fact that older drivers avoid night driving because of visibility problems.

* Only 3 accidents with a driver over the age of 65, involved alcohol.

* Fifty five percent of all accidents involved a male driver.

* Eighty percent of all two car collisions involved a male and a female driver rather than two male drivers or two female drivers, even though the probability is only 30% for that occurrence.

III. FUNCTIONAL CLASSIFICATION

Since the City of Hamilton has not been involved in the development of a formal transportation plan, this traffic operations study will provide a basis for developing a preliminary hierarchy of streets based on existing conditions. The functional classification, contained herein, will provide a base from which to develop future planning efforts when the level of growth requires an overall transportation planing effort.

A. JURISDICTIONAL CONTROL

There are three governmental concerns responsible for the system of streets and roads in and around Hamilton. The State of Montana, through the Montana Department of Highways, has jurisdictional control over US 93, a primary highway; Main Street (FAS 531), a secondary highway; and FAS 269 (Marcus Street and the Eastside Highway), a secondary highway. The City of Hamilton has control of all other streets within the city limits and Ravalli County has control of all area streets beyond the city limits, depending upon agreements between the city and the county. Even though these streets fall under separate jurisdictions, improvements to the street system must be considered on the basis of a total system. Coordinated efforts will be required when the city considers improvements on streets under the state or counties jurisdiction.

B. CLASS DEFINITIONS

The functional classification of streets cannot be based only on traffic volumes. Other considerations must be made to insure a complete and balanced street system. Classifications, for the purpose of this study, are defined as follows:

> **Major Arterial (State Primary)** - are state or national routes which serve interstate and intrastate trips for the movement of people and goods. When they traverse urban areas, they are usually a part of the major arterial roadway system.

Major Arterial (State Secondary) - are state routes which serve intra-state trips, usually between two cities or other significant origins and destinations. When they pass through an urban area they become part of the arterial system as a major or minor arterial.

Minor Arterial - are intended to serve a high degree of mobility with less emphasis on access. Operations are intended for higher speeds, higher levels of service, and serve longer trip lengths through continuity.

Collector Streets - provide an essential transportation function as a link between the arterial system and local access streets. Speeds are generally slower and access is less controlled than arterials. Continuity is limited to distances between arterials.

CBD Streets - are local streets which serve both access and circulation within the Central Business District. Speeds are low; turning movements are high; and pedestrian movements must be accommodated. Parking and traffic movements are closely controlled. Continuity is limited to the boundaries of the business land use.

Local Streets - have a primary function of access. Trips lengths are short and speeds and volumes are low.

C. STREET CLASSIFICATIONS

The map shown in Figure III-1., on the following page is the recommended functional classification of streets in the Hamilton area. This classification is based on the above noted classification descriptions. If adopted as an official classifications system, future improvements to these streets and approval of developments along these streets should be tailored to the requirements of the street's classification requirements. This classification does not preclude the use of traffic control devices which control vehicular right-of-way. A stop sign may be used on a collector if conditions warrant.

LEGEND

- Major Arterial State Primary
- Major Arterial State Secondary
- Minor Arterial & State Secondary
- Collector Streets
- Central Business District Streets
- Local Streets

North

Scale : 1" = 1,400'

CITY OF HAMILTON, MONTANA

EAST HIGHWAY

FAS 269

OLD CORVALLIS RD

RIVERSIDE CUTOFF

KOART SOUTH APP RD

US 93

TO MISSOULA

RIVER RD

COUNTY FAIRGROUNDS

HOXFELD AVE

SKEELS ST

TAULMAN AVE

MILL ST

MARCUS ST

JAMMY ST

DALY AVE

GOLF COURSE RD

ROOSEVELT LN

LEWIS LN

COOPER LN

GRANTSDALE RD

LINCOLN LN

FIRST ST

HONEY

THOPE AVE

US 93 TO DARBY

BAKER ST

DRIVE

DESTA DR

MONTANA AVE

BARTY AVE

SUDEY LN

LINCOLN AVE

BELMONT AVE

GENEVA AVE

ERIE AVE

ESSEX AVE

PERRY ST

ADRIANA AVE

NEW YORK

FRANKLIN

SARANAC

IRVING

PINE ST

CHERRY

PINCKEY

MAIN

1ST STATE

MADISON

HAVRE

DESERET

HICKORY

6th ST

7th ST

8th ST

9th ST

10th ST

PATRICK ST

CITY LIMITS

RIVER PARK

RIVER

BICKETTS RD

BLODGET VIEW

OERTLI RD

OERTLI LN

WEST BRIDGE RD

MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave #204 Billings, Montana 59102	CITY OF HAMILTON TRAFFIC OPERATIONS STUDY	FIGURE III-1. FUNCTIONAL CLASSIFICATION

IV. OPERATIONAL OBSERVATIONS

All aspects of the Hamilton street system were observed and every street segment was video taped. The following sections are a summary of the most significant observations noted during the course of the study. The conditions noted as well as the reason for their significance Is detailed.

A. DRIVER BEHAVIOR

Driver behavior, in terms of traffic operations, refers to habitual characteristics which are unique to a particular city, state or region of the country. Major differences must be noted to determine the level of traffic control acceptable to the local driving population. Calculations Involving signal timing, traffic gap acceptance and right-of-way control all depend, to some degree, on local driver factors. Local characteristics also extend to pedestrians and pedestrian behavior.

It is apparent that Hamilton is still in a transition stage from sleepy town to growing city. There is a wide diversity of driver characteristics on all streets within the system. Traffic signal or stop sign "headways" (the time required to clear an intersection from a complete stop or the time between successive vehicles in an intersection queue) is not much different than in larger Montana cities. However, headways at intersections are not as consistent as in larger cities probably because of the aged drivers and rural based drivers.

Knowledge in the proper use of special turn lanes is not as high as it should be. It is estimated that approximately 20% of drivers using continuous left turn lanes either enter the lane at an inappropriate location; partially block the thru lane; or never enter the lane to make a turn.

Pedestrians, especially children, avoid sidewalks in residential areas. Of all pedestrian observations outside of the CBD, which was substantial, not one person used a sidewalk. They preferred to walk along or in the middle of the street. In the CBD, jay walking composes approximately 40% of all street crossings. When angle parking conditions are considered, it becomes a very serious matter.

The method of parking vehicles, which is detailed in the following section, is apparently a habitual problem throughout the city. In almost every area of the city, it was noted that some vehicles are parked parallel to the curb facing the wrong way; parked skew to the roadway next to parallel parked vehicles; parked on corners; and parked in the middle of the street. The consistency of improper parking throughout the city plays a significant role in existing traffic operation problems.

US 93, with its multi lane operation, presents great difficulties for the aged driver. Traffic volumes have increased to a point where there are very few acceptable gaps for older drivers. Drivers were observed waiting at side streets and business approaches for significant periods of time trying to enter or cross US 93. In frustration and sometimes, confusion, these drivers would finally pull onto the roadway whether an adequate gap existed or not.

B. PARKING

Parking, as shown by accident statistics and confirmed by observations, is the single worst problem related to traffic operations in Hamilton. In the Central Business District, almost all parking is angle parking. Main street is 76 feet wide, which makes angle parking almost tolerable, but the side streets are just over 50 feet wide, which creates lanes too narrow for thru traffic, even without cars backing into thru traffic. Angle parking maneuvers have twice as many points of conflict or potential collision than the same street with parallel parking. To make matters worse, the backing movement into thru traffic is completely blind. Since only one of the two drivers has full control over a potential conflict, avoidance of a collision is dependent upon the skill and ability of that driver. Given these circumstances, the accident potential involved with angle parking is at least four times as high as parallel parking. Accident statistics suggest the actual rate is probably a factor of 10 or more. In addition, pedestrians are at an increased risk because of sight distance restrictions and a longer distance to cross wider streets associated with angle parking.

Angle parking also creates traffic operational problems that are not so easily defined by parking accidents or number of conflict points. Thru traffic, while proceeding down the street, may observe numerous vehicles backing into the street from either side; vehicles turning into spaces from both sides of the street; pedestrians standing at the back of cars waiting to cross; vehicles stopped in the street waiting for a parking maneuver; and a signal light change. All of these activities are very likely happening at

the same time. Even a young person, with excellent driving abilities, would be overloaded with visual information and if any immediate conflict occurred, he would probably be unable to avoid it. This situation worsens dramatically for the older driver. Many studies have concluded that a driver can only process a certain amount of information at anyone time. When that threshold is exceeded, accidents occur. Considering the situation in Hamilton's CBD, it is suspected that a number of accidents not reported as parking accidents were the indirect result of the chaos caused by angle parking. In addition to safety problems, efficiency of the street system is severely degraded by angle parking. Statistical calculations combined with capacity estimation methods indicate that the capacity of a two lane street is reduced by a minimum of 20% when angle parking is allowed.

The photos below, illustrate some of the problems referred to in the above narrative.

A view east on Main Street shows typical activities.

Note jay walkers!

A 35' RV is angle parked (legally) near intersection with First Street. There is a right turn lane on the other side of the RV. One and a half lanes are blocked.

The apparent reason for angle parking in the CBD area is the need for more parking spaces. However, angle parking was observed on various types of street throughout the City. In a few instances, angle parking was being used in front of brand new buildings which appeared to have ample space for on-site parking.

Just about every parking condition that is prohibited by the Montana Motor Vehicle Code was observed. The following is a list of locations vehicles were observed parked:

* On sidewalks
* On a crosswalk
* Within 20 feet of a crosswalk
* Within 30 feet of the curb radius point
* Within 50 feet of a railroad crossing
* Double parked
* Facing the wrong direction

C. TRAFFIC CONTROL DEVICES

Traffic control devices in Hamilton are not any worse than can be found in most Montana cities. An honest effort has been made to place signs and markings where they are needed and there were no locations where traffic control devices created a dangerous situation. The following sections describes the inadequacies as observed.

1. SIGNS

There were two critical problems regarding traffic signs noted. Non standard signs are the first and most common problem. Approximately 75% of all street name signs in Hamilton are non reflective black on white signs and the other 25% which are white on green reflectorized are mostly too small or do not have a border. Street name signs are an important part of traffic operations because they provide positive guidance and if highly legible, reduce decision time required by motorists. In addition, there doesn't seem to be a standard location where they are mounted.

The other critical problem is the location and mounting condition of the signs. Very few of the signs in Hamilton are mounted at the correct height above the roadway. In

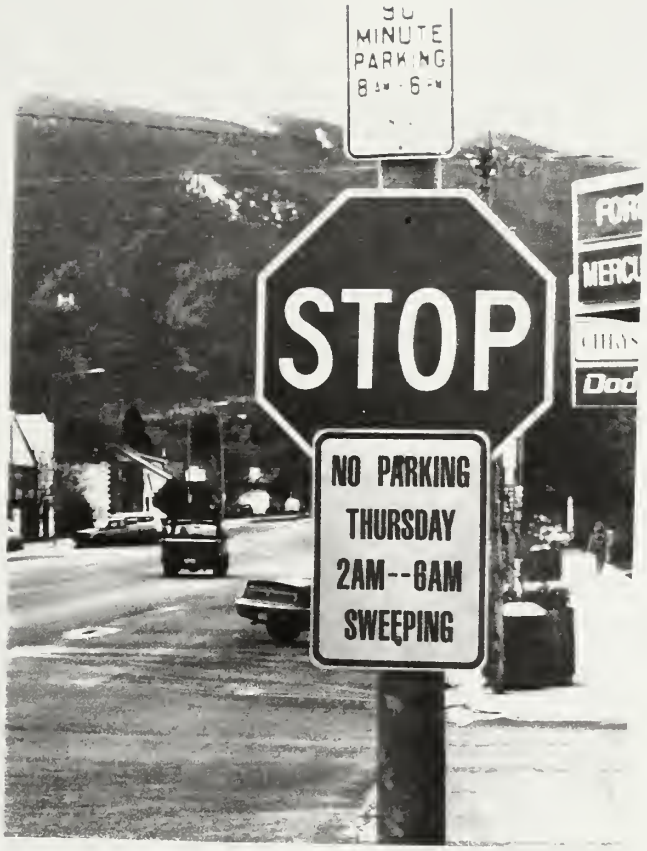
the CBD, signs are facing at an angle inappropriate for the person who has to see it and with angle parking, signs are too far from the traffic lane to be in the normal angle of the drivers vision.

The following photos illustrate some of the problems observed in Hamilton.

Home made sign with solid mounting. Its too far from the street and cannot be taken seriously.

Standard parking signs combined with regulatory sign on the same pole. Signs overlap and cover message. Sign is too far from street to be read.

Too many signs on one pole leads to overlaps. While no legend is covered, the basic shape of the stop sign is altered. For those with failing vision the shape assists in immediate perception.



Mounting height of signs is important, for driver visibility and pedestrian safety. Signs on far corner, look as if they slid down the pole. Pedestrians could walk into it and injure themselves. They are almost invisible from the drivers view.

Combination sign does not provide clear message. Is it 90 minute parking only for the handicapped?

Where can a person park around here? Fortunately, three of the signs will be hidden when the tree grows.

This sign may be able to replace the four signs in the above photo.

2. MARKINGS

None of the local streets in Hamilton have centerline pavement markings. The only markings evident other than on Main Street and US 93 are crosswalk lines at school crossings. School crossings appear to be amply marked and signed within the City. A good attempt was also made to mark no parking spaces next to intersections. The photos below indicate some of the problems observed.

Plastic markings at Main and US 93 have worn badly and are barely visible.

Parking restrictions, marked at intersections, are a good attempt at controlling the corners for sight distance and pedestrians. Note sharp curb point. It is hazardous for turning vehicles and reduces the distance of the actual parking setback.

3. SIGNALS

There are three signal installations on First Street (US 93). The intersection of Main and 93 was first installed with the street reconstruction project. Later, approximately one year ago, signals were installed at the intersections of US 93 at Adirondac Street and at Golf Course Road. All three signals have Traconex, solid state, NEMA, 8 phase controllers which are current state of the art. None of the controllers have emergency vehicle detection units or discriminators to provide emergency vehicle phasing. The signal at Main and US 93 controls multi lane approaches with left turn lanes marked on US 93. This signal provides two phases for north-south and east-west traffic. It operates on a fixed time basis with a 70 second cycle and there are no pedestrian push buttons. Timing is set to provide a 7 second walk indication for US 93 crossings and 15 seconds for Main crossings. The signals at Adirondac and at Golf Course Road have the same operating characteristics. There are no exclusive left turn lanes; they operate with vehicle actuation for the east-west approaches; and pedestrians push buttons are present.

Operational problems noted at these intersections include angle parking immediately adjacent to the westbound approach in the northeast corner of the Adirondac intersection, which interferes with free vehicle movement and unnecessary actuations. Sidewalks stop about ten feet short of signal poles on which pedestrians push buttons are mounted. This makes it difficult for people, especially the aged, to access the buttons.

At Golf Course Road, left turning traffic on the north approach stacks in queues waiting for a gap in opposing traffic. A convenience store/gas station in the northeast corner has approaches near the intersection. The left turn queue blocks the view of southbound vehicles turning into the approach from northbound thru traffic. Several near collisions were noted. This intersection also has partially inaccessible pedestrian push buttons.

At the Main Street intersection, the westbound approach from Marcus Street has lane designations only on the pavement, which are no longer visible. Vehicles frequently use the wrong lanes. The three lanes on the eastbound approach seem inappropriate for turning volumes. They also do not line up with Marcus Street appropriately, which causes additional confusion for both east and west approach traffic. None of the intersections have overhead lane control signs. In addition, long queues build on the

Main Street approach which occasional extend into the Second Street intersection.

A span wire mounted signal installation exists at the intersection of Second and Main. There are four signal heads, one for each approach. The exact type of controller is not known because it is mounted of the roof of an adjacent building. It operates on a fixed time 60 second cycle. There are no pedestrian indications, which provides a guessing game for people walking up to the signal. Twenty four seconds are required for pedestrians crossing Main Street, while the green phase only allows 21 seconds. The lack of sufficient signal heads and pedestrian signals make this signal completely inadequate for the given conditions. The photo below show the southbound approach to this intersection.

The intersection of Third Street and Main has a flashing beacon for a four way stop. The beacon was probably installed because the stop signs are almost always hidden by parked vehicles. Even with the beacon, it is difficult to perceive the stop while traveling on Main Street. In addition, four way stop intersections are hazardous to pedestrians because drivers attention is diverted to other vehicular traffic.

D. SIGHT DISTANCE

Within the residential areas of Hamilton, intersection sight distance is very good. The City has done an admirable job in clearing sight restrictions at corners. With only some exceptions shrubs are kept low and tree branches are kept high. Illegal parking in these areas are the only obstructions to sight distance noted.

In the CBD and other commercial areas, angle parking completely blocks proper intersection sight distance. With angle parking, intersection sight distances require extended parking setbacks. Considering that none of the corners have curb radii, the setback problem is intensified.

E. SYSTEM & STREET DEFICIENCIES

Strip development along US 93 is the biggest deficiency in the Hamilton street system. Almost all significant internal trips are combined with external and thru trips which causes high traffic volumes on a single street within a small city. US 93 also acts as a barrier to balanced traffic flow within the community. Unfortunately, the railroad tracks parallel US 93 and acts as a double barrier. When development intensifies on the east side of Hamilton and traffic volumes crossing these barriers increases, significant traffic operation problems will occur at all of the major and minor approach streets. Mill Street and Honey Street, which parallel the tracks on the east side, are not continuous and have a substandard surface and typical section. When combined with problems of uncontrolled access, they cannot possibly function as a parallel collector or arterial.

Some of the main thru streets within the cities jurisdiction have cross drains favoring the minor street, which causes the main traffic flow to slow at intersections which stop the minor street traffic. At present, traffic volumes are not high enough to create significant problems. Future traffic increases will add significance to this problem.

Main Street, on the west end of Hamilton, has a typical section which drains water to the middle of the street and is collected by mid street inlets. This is a very unusual situation and considering that the middle of the street is marked for two way left

turns, it may be an operationally inefficient situation. Pavement markings become silted over and wear away quicker. In periods of intense rain, the left turn becomes unusable and runoff could conceivably rise to a level which would cover the thru lanes as well.

A significant portion of Hamilton does not have adequate drainage facilities or curb and gutter. While drainage is important in retaining the structural integrity of the street section, it also affects traffic operations to some degree. Fourth Street, south of Main, has an excellent drainage system with curb and gutter and curb inlets. The street surface is uniform and the curb line provides a well defined parking area. The area of Hamilton east of US 93 is the exact opposite. Lack of curb and drainage facilities provides ill defined street alignments and rough surfaces with no control of side approaches. Traffic operations become very difficult on these streets, once traffic volumes become high.

V. PROBLEM IDENTIFICATION

Street system operations can be only be evaluated for the basic service they provide. The two measures of service are safety and efficiency. Analysis of these operational considerations are summarized in the following sections.

A. CAPACITY

From the study of average daily traffic volumes and observation of traffic operations during the peak traffic periods, several locations were suspected of being at or below capacity. Turning movement counts were taken during the peak hour periods at these locations. The HCS software developed by FHWA was used to compute the capacity of these areas. The intersection locations analyzed were:

First & Main Street
First & Golf Course Road
First & Adirondac Street
First & Pine Street
First & Pinckney Street
First & State Street
First & Bedford Street
Main & Second Street
Main & Third Street
Main & Fourth Street
Main & Tenth Street

All of the intersections provide a minimum Level of Service (LOS) "B", except for the intersections of Pine, Pinckney and State Street's with First Street. The left turn movement from the minor street at all of these intersections operates at a LOS "E", which indicates significant delay on the side street. During actual observations, it was noted that the streets are wide enough so that right turn movements usually get around the left turning vehicles without undue delay. In the case of the Pinckney and State Street intersections, delay is not as great as would be indicated by the calculations, because the signal at Main Street provides gaps in traffic that minimize left turn delay.

Calculation of street capacity by current standards does not necessarily include all of the situations encountered. Long queues of vehicles on Main Street between First and Second Streets during the peak hour, would suggest a much lower level-of-service than intersection and arterial capacity calculations would suggest. An independent analysis method created for this particular situation was used to account for angle parking maneuver's effect on capacity. The average angle parking exit movement requires a minimum of 18 seconds from beginning of the backing until forward acceleration to thru traffic speeds. When assuming a parking space turn-over rate of two per hour and approximately 36 spaces per block, 21.6 minutes of an hour would have some sort of thru traffic interference caused by parking maneuvers. A statistical analysis of random arrivals and traffic flow indicates that the capacity of the street would be approximately 20% less than calculated for a normal street with parallel parking. Therefore, Main Street between First and Second is currently operating at approximate LOS "D", which is less than normal design LOS "C".

B. ACCIDENT SCREENING

Vehicular accidents are usually random occurrences that may be caused by a variety of reasons. Accidents are unplanned incidents related to circumstances of time and space. We, as humans, are limited in what we can do to prevent accidents. When accidents consistently occur at a certain location, it is an indication that there is a violation of the random nature of accidents and there may be a problem with the physical conditions at that location. Since no government agency has the funds to correct problems at all of these locations, a method of ranking the problem areas to find the worst situations is necessary. Also, a method to determine the cutoff point is required.

As previously mentioned, all of the accident reports for Hamilton in the past four years were sorted for location and analyzed. A listing of locations was developed which included every area of town that had at least two accidents reported. From this list, a rate for the number of accidents per year, accidents per million vehicles entering, and an average accident severity were computed. Table V-1., on the following pages, is a summary of the accident screening list.

TABLE V-1. CITY OF HAMILTON - ACCIDENT SITE SCREENING LIST
RANKING BY COMPOSITE ACCIDENT FACTOR

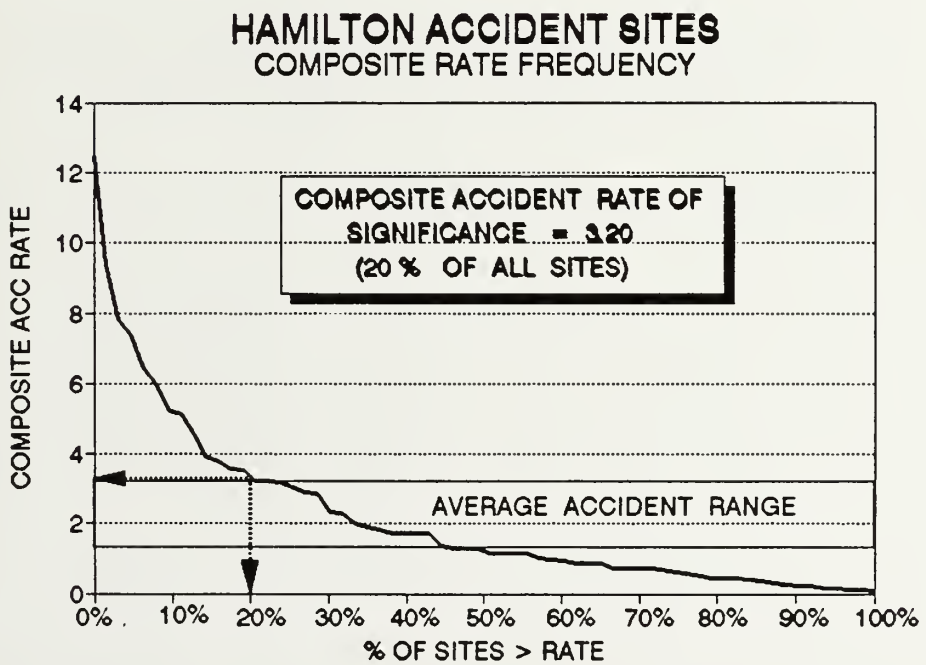
RANK	PRINCIPAL STREET	INTERSECTING STREET OR STREET SECTION	NUMBER OF ACCIDENTS 1987	1988	1989	1990	TOTAL	(1) #ACC/Y RATE	(2) ACCIDEN RATE	(3) SEVER RATE	1x2x3 COMPOS RATE
1	SECOND STREET	100 BLOCK NORTH	3	2	3	5	13	3.25	3.56	1.08	12.47
2	US 93 (FIRST ST)	MAIN STREET	6	11	6	4	27	6.75	1.04	1.33	9.40
3	SECOND STREET	100 BLOCK SOUTH	3	6	0	2	11	2.75	2.60	1.09	7.79
4	MAIN STREET	300 BLOCK	1	5	3	5	14	3.50	1.84	1.14	7.38
5	SEVENTH STREET	RIVER STREET	1	2	2	0	5	1.25	4.28	1.20	6.42
6	THIRD STREET	MADISON STREET	1	3	3	0	7	1.75	2.40	1.43	5.99
7	PINCKNEY STREET	200 BLOCK	4	2	0	1	7	1.75	3.00	1.00	5.24
8	SECOND STREET	DESTSA STREET	1	0	1	1	3	0.75	3.42	2.00	5.14
9	THIRD STREET	SARANAC STREET	2	2	0	0	4	1.00	3.04	1.50	4.57
10	US 93 (FIRST ST)	ADIRONDAC STREET	1	2	4	9	16	4.00	0.75	1.31	3.94
11	SEVENTH STREET	MADISON STREET	1	1	1	1	4	1.00	3.04	1.25	3.81
12	STATE STREET	SIXTH STREET	0	2	2	1	5	1.25	2.85	1.00	3.57
13	US 93 (FIRST ST)	RIVERSIDE CUTOFF	1	2	3	5	11	2.75	0.89	1.45	3.55
14	US 93 (FIRST ST)	GOLF COURSE ROAD	2	4	3	2	11	2.75	0.99	1.18	3.22
15	FIFTH STREET	MADISON STREET	0	0	1	2	3	0.75	2.57	1.67	3.21
16	THIRD STREET	RIVER STREET	1	2	0	1	4	1.00	1.83	1.75	3.20
17	SECOND STREET	RIVER STREET	0	2	1	1	4	1.00	3.04	1.00	3.04
18	MAIN STREET	100 BLOCK	2	4	2	2	10	2.50	1.05	1.10	2.90
19	STATE STREET	SECOND STREET	2	1	3	2	8	2.00	0.96	1.50	2.88
20	SEVENTH STREET	PINE STREET	1	0	2	0	3	0.75	1.87	1.67	2.33
21	FIFTH STREET	RIVER STREET	0	2	0	1	3	0.75	2.28	1.33	2.28
22	STATE STREET	THIRD STREET	1	0	2	4	7	1.75	1.14	1.00	2.00
23	FIFTH STREET	BEDFORD STREET	0	0	2	1	3	0.75	2.57	1.00	1.93
24	SECOND STREET	CHERRY STREET	0	0	2	2	4	1.00	1.83	1.00	1.83
25	EIGHT STREET	BEDFORD STREET	0	0	1	1	2	0.50	2.28	1.50	1.71
26	SECOND STREET	GROVE STREET	1	0	0	1	2	0.50	2.28	1.50	1.71
27	STATE STREET	EIGHT STREET	0	1	0	2	3	0.75	2.28	1.00	1.71
28	US 93 (FIRST ST)	SARANAC STREET	4	2	3	0	9	2.25	0.49	1.56	1.71
29	SIXTH STREET	200 BLOCK NORTH	0	2	0	0	2	0.50	2.74	1.00	1.37
30	FOURTH STREET	MADISON STREET	1	0	1	0	2	0.50	1.71	1.50	1.28
31	STATE STREET	FIFTH STREET	0	1	2	0	3	0.75	1.71	1.00	1.28
32	THIRD STREET	PINE STREET	1	0	2	0	3	0.75	1.28	1.33	1.28
33	PENNSLYVANIA ST	LYNDALE STREET	0	0	2	0	2	0.50	2.28	1.00	1.14

Table V-1. cont.

RANK	PRINCIPAL STREET	INTERSECTING STREET OR STREET SECTION	NUMBER OF ACCIDENTS 1987	1988	1989	1990	TOTAL	(1) #ACC/Y RATE	(2) ACCIDEN RATE	(3) SEVER RATE	1x2x3 COMPOS RATE
34	SECOND STREET	BAKER STREET	1	0	1	0	2	0.50	2.28	1.00	1.14
35	STATE STREET	FOURTH STREET	2	0	1	1	4	1.00	1.14	1.00	1.14
36	SECOND STREET	SARANAC STREET	0	0	2	0	2	0.50	1.52	1.50	1.14
37	US 93 (FIRST ST)	PINCKNEY STREET	4	1	3	1	9	2.25	0.41	1.11	1.03
38	US 93 (FIRST ST)	RAVALLI STREET	1	5	1	0	7	1.75	0.39	1.43	0.98
39	PINCKNEY STREET	100 BLOCK	1	0	2	0	3	0.75	1.28	1.00	0.96
40	ADIRONDAC STREET	600 BLOCK	0	0	1	1	2	0.50	1.71	1.00	0.86
41	SIXTH STREET	BEDFORD STREET	1	0	1	0	2	0.50	1.71	1.00	0.86
42	THIRD STREET	NEW YORK STREET	1	1	0	0	2	0.50	1.71	1.00	0.86
43	SECOND STREET	BEDFORD STREET	0	0	0	2	2	0.50	1.52	1.00	0.76
44	SECOND STREET	300 BLOCK SOUTH	1	0	1	0	2	0.50	1.52	1.00	0.76
45	STATE STREET	SEVENTH STREET	1	1	0	0	2	0.50	1.52	1.00	0.76
46	US 93 (FIRST ST)	MP 47.5 TO 48.3	1	3	4	5	13	3.25	0.16	1.38	0.74
47	SECOND STREET	200 BLOCK SOUTH	0	0	2	0	2	0.50	0.91	1.50	0.68
48	US 93 (FIRST ST)	900 BLOCK	2	1	2	1	6	1.50	0.33	1.33	0.65
49	US 93 (FIRST ST)	BAKER STREET	3	1	0	2	6	1.50	0.34	1.17	0.60
50	SECOND STREET	PINE STREET	1	0	1	0	2	0.50	0.68	1.50	0.51
51	US 93 (FIRST ST)	SILVER BRIDGE	0	0	1	3	4	1.00	0.37	1.25	0.46
52	MAIN STREET	SEVENTH STREET	0	1	1	1	3	0.75	0.59	1.00	0.44
53	US 93 (FIRST ST)	PINE STREET	1	1	4	0	6	1.50	0.29	1.00	0.44
54	US 93 (FIRST ST)	STATE STREET	1	2	2	1	6	1.50	0.27	1.00	0.41
55	MAIN STREET	FOURTH STREET	0	2	1	1	4	1.00	0.39	1.00	0.39
56	THIRD STREET	100 BLOCK NORTH	2	0	0	0	2	0.50	0.62	1.00	0.31
57	MAIN STREET	200 BLOCK	0	0	1	2	3	0.75	0.34	1.00	0.26
58	MAIN STREET	SECOND STREET	1	1	0	1	3	0.75	0.23	1.33	0.23
59	US 93 (FIRST ST)	SKEELS STREET	0	3	0	0	3	0.75	0.23	1.33	0.23
60	US 93 (FIRST ST)	MADISON STREET	0	1	1	1	3	0.75	0.17	1.33	0.17
61	US 93 (FIRST ST)	PENNSYLVANIA STREET	0	2	1	0	3	0.75	0.15	1.33	0.15
62	US 93 (FIRST ST)	GROVE STREET	1	0	1	1	3	0.75	0.17	1.00	0.13
63	US 93 (FIRST ST)	FRANKLIN STREET	1	1	0	0	2	0.50	0.11	2.00	0.11
		TOTALS =	68	88	92	80	328				
		AVERAGES =						1.24	1.41	1.18	2.11

Each of the accident factors were ranked separately and plotted. None of the factors provided a uniform or definable curve individually. However, the product of these factors produced a graphic plot that could be used to statistically define a point of significance, or the cutoff point.

Figure V-1., below, is the graphic plot of this data. This is a plot of composite accident rate verses the percentage of sites greater than that rate. Statistically, the point of significance was found to be a composite rate of 3.2, which indicates that 20% of all sites have a significant accident problem. The average accident range is somewhere between 3.2 and 1.7. All sites less than 1.7 are below average.



C. PROBLEM STREET CORRIDORS

A sorting procedure was utilized to determine the number and location of intersections along each street corridor which had significant accident problems. In most instances, intersection accidents occurred in patterns within the street system and at least six corridors were identified as those which have significant accident problems. Table V-2, below, is a summary of the corridor locations and there ranking according to composite accident factors.

TABLE V-2. CITY OF HAMILTON - CORRIDOR ACCIDENT LOCATIONS
RANKED BY COMPOSITE ACCIDENT FACTOR

			NUMBER OF ACCIDENTS					(1) #ACC/Y	(2) ACCIDEN	(3) SEVER	1x2x3 COMPOS
RANK	STREET CORRIDORS	SECTION LOCATION	1987	1988	1989	1990	TOTAL	RATE	RATE	RATE	RATE
1	MAIN STREET	FIRST TO FOURTH	4	12	7	11	34	34.0	15.5	1.1	590.0
2	STATE STREET	SECOND TO EIGHT	6	6	10	10	32	19.0	22.7	1.1	486.2
3	THIRD STREET	PINE TO NEW YORK	5	5	2	1	13	11.2	25.6	1.5	419.1
4	SECOND STREET	GROVE TO RIVER ST	11	10	14	14	49	13.6	18.6	1.2	300.4
5	US 93 (FIRST ST)	GOLF COURSE TO PENN	29	42	39	35	145	25.9	5.6	1.3	190.0
6	PINCKNEY STREET	FIRST TO THIRD	5	2	2	1	10	8.9	15.3	1.0	136.5
		TOTALS =	60	77	74	72	283				
		AVERAGES =						18.78	17.23	1.20	353.69

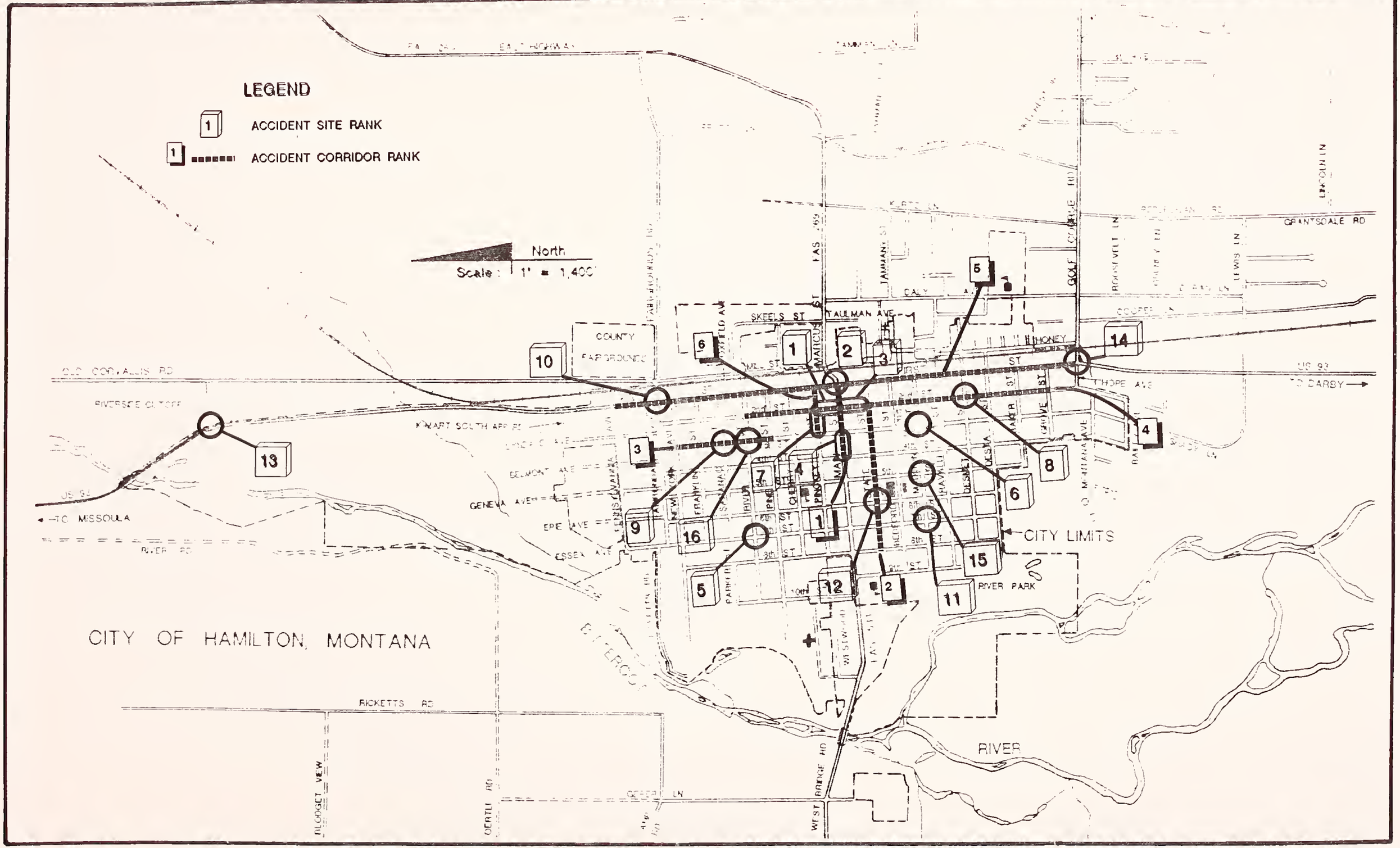
** NUMBER OF ACCIDENTS RATE IS # ACC/YEAR/MILE*

ACCIDENT RATE IS # ACC/MILLION VEHICLE MILES

D. ACCIDENT CLUSTER SITES

Based on the analysis of statistical significance, all of the intersection and street segment sites with a composite accident factor of 3.2 and greater are considered to be the locations in Hamilton with the greatest safety needs. Therefore, the first 16 sites listed in Table V-1. were included as detailed study sites. Figure V-2. on the following page is a map showing the location of all the problem sites and corridors. In many cases, significant sites and corridors overlap. Because of this overlap, intersections included in a corridor are addressed as part of the corridor. When these sites are combined in this manner, the following sites remain as isolated problem areas.

1. **Seventh Street & River**
2. **Third Street & Madison**
3. **Seventh Street & Madison**
4. **Fifth Street 7 Madison**
5. **US 93 & Riverside Cutoff**



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CITY OF HAMILTON
TRAFFIC OPERATIONS STUDY

FIGURE V-2
ACCIDENT PROBLEM LOCATIONS

VI. SITE SPECIFIC RECOMMENDATIONS

This section of the report deals with recommendations for improving the safety and efficiency of traffic operations in Hamilton. All of the sites reviewed within the scope of this study are discussed and appropriate drawings are presented when necessary to clarify the meaning of recommendations. Individual intersections which were determined to have a significant accident problem can be found in the "Problem Intersection" section, if they are not part of a problem corridor.

A. PROBLEM INTERSECTIONS

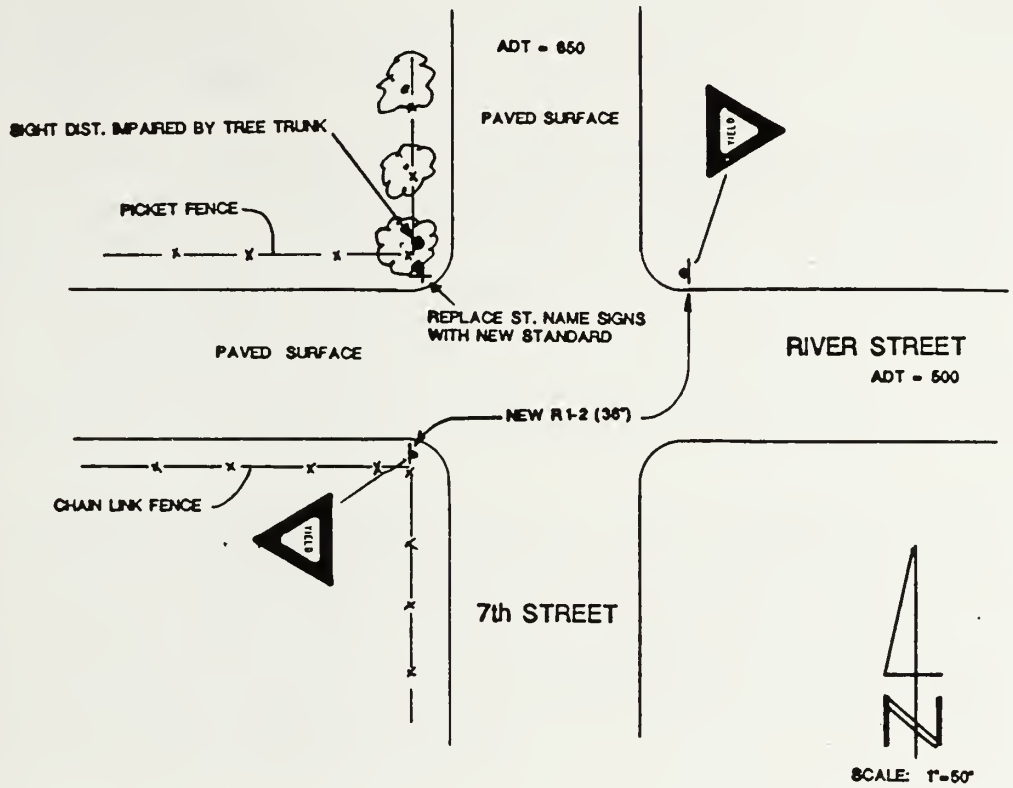
The intersections detailed within this section are those which were found to have significant accident problems, but are not part of a recognized street corridor having accident problems.

1. SEVENTH STREET & RIVER STREET

Figure VI-1. shows the pertinent geometry, roadside features and traffic control devices that exist at this intersection. Also shown are the recommended changes to improve safety.

There were a total of 6 accidents in the reporting period at this intersection. They were all angle accidents. The most predominant accident were collisions involving southbound and westbound vehicles. Sight distance is somewhat impaired in the northwest corner and the lack of curb & gutter inhibits control of parking. Other than the possibility of vehicles parking too close to the intersection, there is no other obvious conditions contributing to the high accident rate. It is suspected that there may be confusion by drivers that one of the other streets is a through street.

In order to assist drivers in the decision of right of way and to effect some measure of control at this intersection, it is recommended that "Yield" signs be placed on River Street and new larger white on green street name signs replace the existing black on white signs to aid drivers unfamiliar with the area (20% of drivers were from out of town). This recommendation is for the short term. If accidents persist, stop signs should be considered. The Police Department should also monitor this area for corner parking violations (see "General Recommendations).



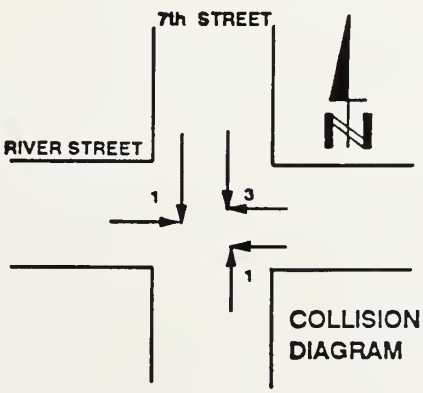
SITE LOCATION: SEVENTH STREET & RIVER STREET

ACCIDENT DATA				
TIME PERIOD:	JAN 1, 1987 TO DEC 31, 1990			
	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	4	1	0	5
REAREND	0	0	0	0
SIDESWIPE	0	0	0	0
SINGLE V	0	0	0	0
PEDESTRN	0	0	0	0
OTHER	0	0	0	0
TOTAL NO. ACC =	4	1	0	5

	1987	1988	1989	1990
ACC. IN YEAR:	1	2	2	0

	NITE	DAY	
% ACCIDENTS AT:	0.0%	100.0%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	100.0%	0.0%	0.0%	0.0%



COLLISION DIAGRAM

FIGURE NO. VI-1.

TITLE: SEVENTH & RIVER IMPROVEMENTS

2. THIRD STREET & MADISON STREET

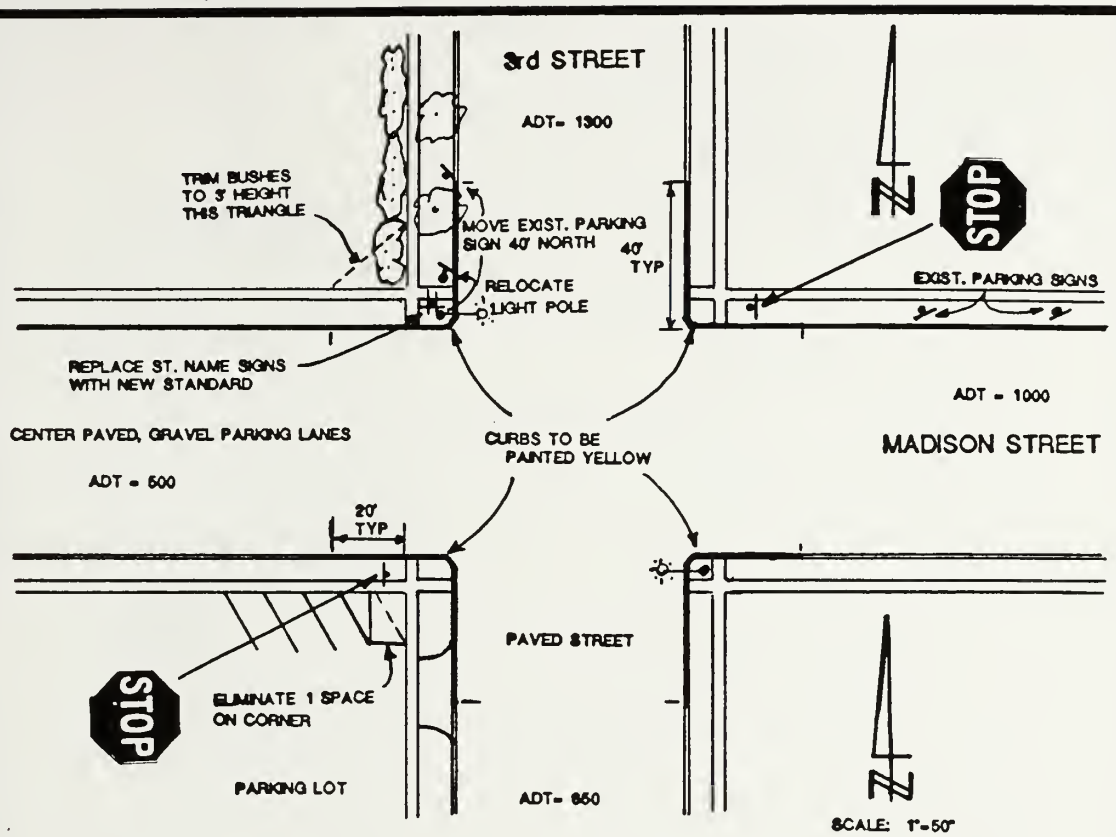
Figure VI-2. illustrates existing conditions and recommended improvements at this intersection. Third and Madison is located on the fringe of the CBD and there is an imbalance between traffic volumes on the four legs of the intersection. A significant portion of the traffic is circulation traffic and not thru traffic. Curb & gutter exists on all legs while parking patterns are mixed. Third street, north of the intersection, has angle parking on the west side. All other streets have parallel parking. There is an off street parking lot, which is located in the southwest corner of the intersection.

There were seven accidents in the reporting period, six of them were angle accidents. From the accident reports it appears that the intersection was uncontrolled as late as 1989. At some point after that, the intersection was controlled by stop signs on Madison. It appears as if the stop signs may be working, since no accidents were reported in 1990. However, there are some sight distance problems at this intersection that are not adequate even with the stop control.

The curb & gutter should be marked for no parking by painting them yellow as indicated. One space in the parking lot should be removed to improve the line of sight. Bushes in the northwest corner should be trimmed so that they do not exceed a height of 30" as measured from street elevation. The light pole in the northwest corner presents a hazard, as it is too close to the road and should be move north. Parking signs must be relocated to comply with the corner restrictions and the street name signs should be replaced with the new standard white on green. Implementation of these improvements should provide aesthetic as well as potential safety improvements.

3. SEVENTH STREET & MADISON STREET

Figure VI-3. presents the existing conditions and recommended improvements at this intersection. It is an intersection of two local streets with approximately the same traffic volumes. Both streets are paved in a fashion that is fairly typical in Hamilton, a center strip of paving approximately 30' wide exists with wide gravel parking lanes. In this case there is no curb and gutter, but some sidewalk sections exist. The wide gravel parking area presents an opportunity for vehicles to park in any manner desired and it is difficult to delineate corner parking restrictions.



SITE LOCATION: THIRD STREET & MADISON STREET

ACCIDENT DATA

TIME PERIOD: JAN 1, 1987 TO DEC 31, 1990

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	4	2	0	6
REAREND	0	0	0	0
SIDESWIPE	1	0	0	1
SINGLE V	0	0	0	0
PEDESTRN	0	0	0	0
OTHER	0	0	0	0
TOTAL NO. ACC =	5	2	0	7

	1987	1988	1989	1990
ACC. IN YEAR:	1	3	3	0

	NITE	DAY	
% ACCIDENTS AT:	28.6%	71.4%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	28.6%	0.0%	42.9%	28.6%

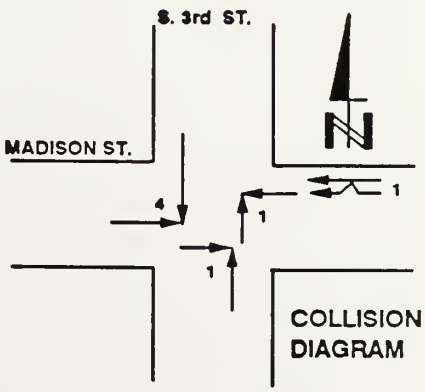
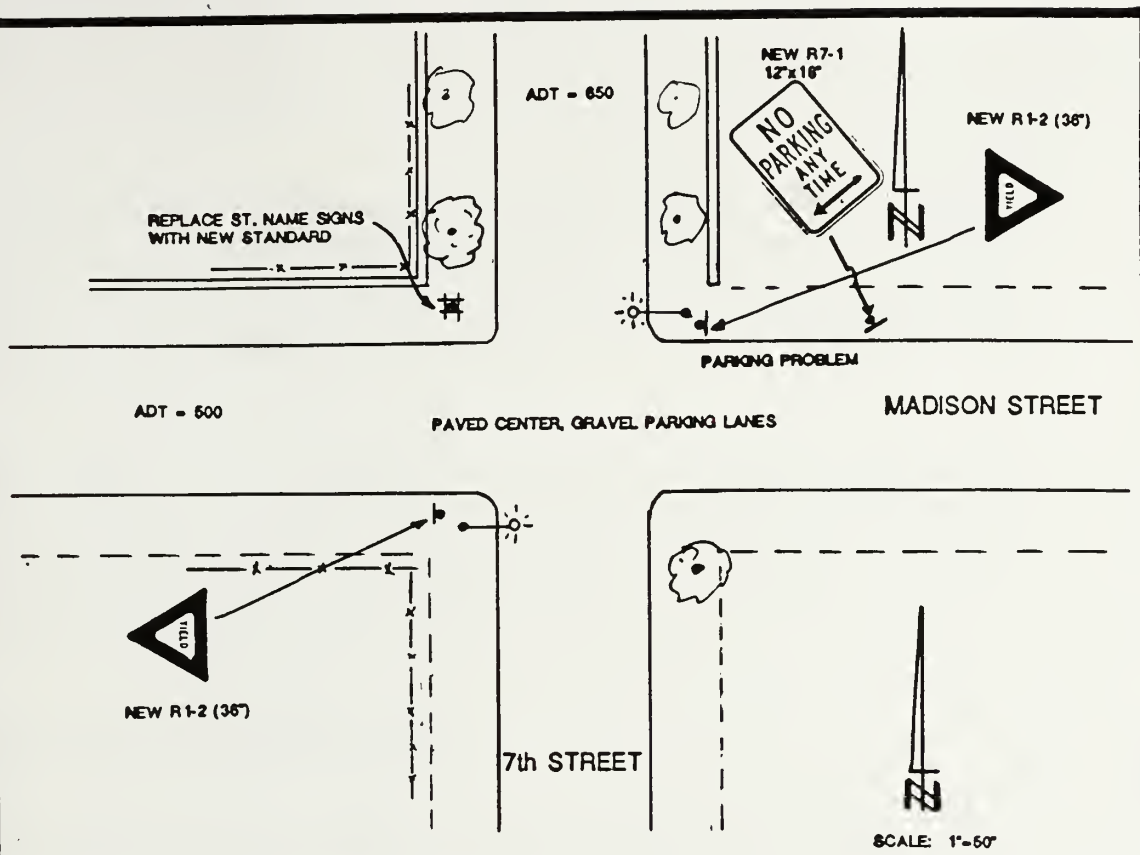


FIGURE NO. VI-2.

TITLE: THIRD & MADISON IMPROVEMENTS



SITE LOCATION: SEVENTH STREET & MADISON STREET

ACCIDENT DATA

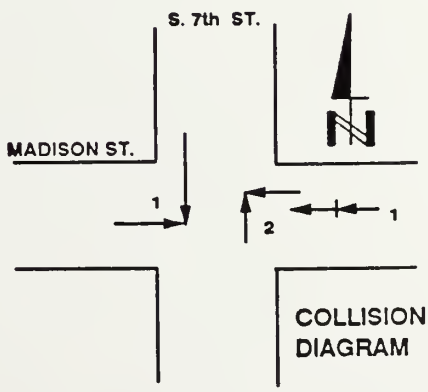
TIME PERIOD: JAN 1, 1987 TO DEC 31, 1990

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	2	1	0	3
REAREND	1	0	0	1
SIDESWIPE	0	0	0	0
SINGLE V	0	0	0	0
PEDESTRN	0	0	0	0
OTHER	0	0	0	0
TOTAL NO. ACC =	3	1	0	4

	1987	1988	1989	1990
ACC. IN YEAR:	1	1	1	1

	NITE	DAY
% ACCIDENTS AT:	25.0%	75.0%

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	100.0%	0.0%	0.0%	0.0%



COLLISION DIAGRAM

FIGURE NO. VI-3.

TITLE: SEVENTH & MADISON IMPROVEMENTS

There were four accidents reported at this intersection, three of them were angle accidents. No particular accident pattern was indicated by the reports. There are no permanent sight distance restrictions at this intersection and circumstances indicate that accidents are occurring because of parked vehicles or confusion with through street designations.

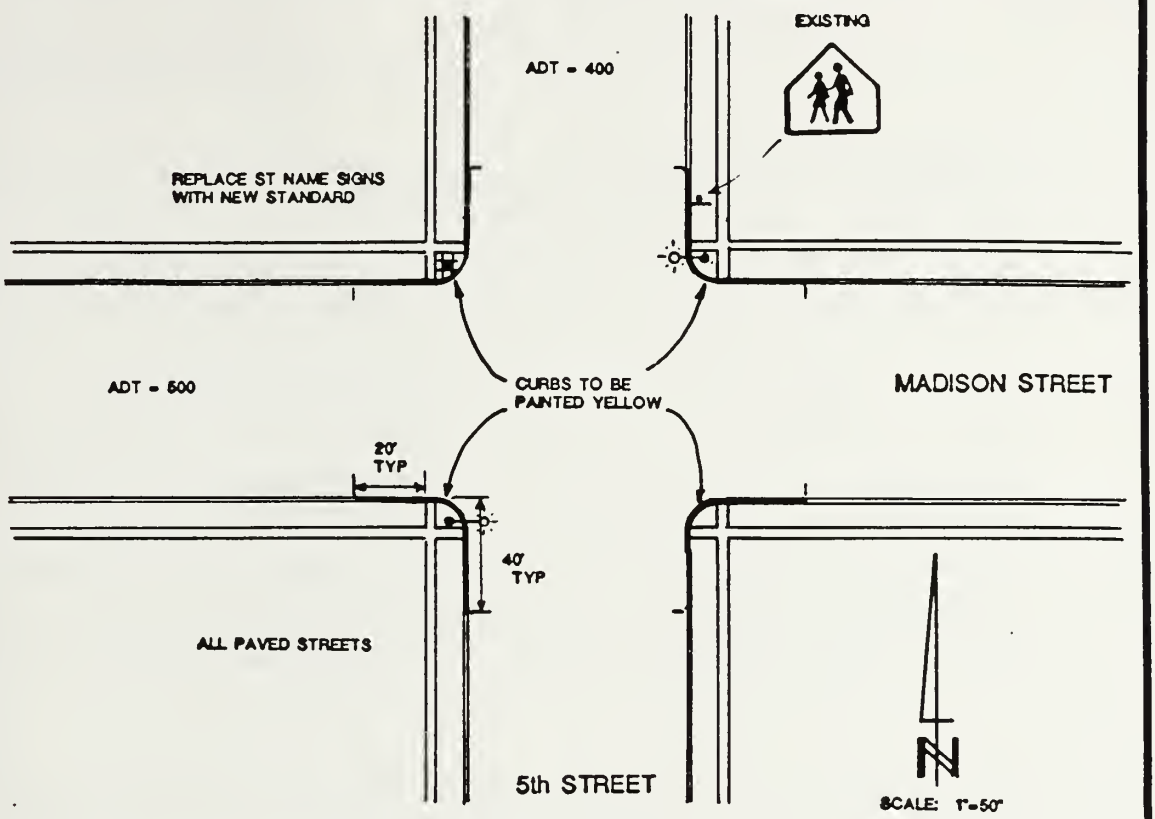
As in site number 1., it is recommended that "Yield" signs be used to designate right of way as a short term measure. In addition, police should monitor the area for corner parking violations. The street name signs should also be replaced with the new white on green standard signs, to further aid motorists.

4. FIFTH STREET & MADISON STREET

Figure VI-4. shows the existing conditions and recommended improvements at this intersection. The intersecting streets are very wide (60') and are completely paved between curb & gutter sections. No permanent sight distance restrictions are present and there are no traffic control devices other than an advance school crossing sign on the northbound departure leg.

There were 3 accidents in the reporting period. All of them were angle accidents involving southbound vehicles. No other contributing circumstances could be found other than a temporary loss of the line of sight.

Correct parking restrictions should be marked at the corners by painting the curb yellow as indicated on the drawing. Further control of the intersection does not seem feasible at this time. If the accident problem continues, after parking restrictions and police monitoring has been implemented, yield control should be considered. As at most other intersections in Hamilton, the street name signs should be upgraded.



SITE LOCATION: FIFTH STREET & MADISON STREET

ACCIDENT DATA

TIME PERIOD: JAN 1, 1987 TO DEC 31, 1990

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	1	2	0	3
REAREND	0	0	0	0
SIDESWIPE	0	0	0	0
SINGLE V	0	0	0	0
PEDESTRN	0	0	0	0
OTHER	0	0	0	0
TOTAL NO. ACC =	1	2	0	3

	1987	1988	1989	1990
ACC. IN YEAR:	0	0	1	2

	NITE	DAY
% ACCIDENTS AT:	33.3%	66.7%

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	66.7%	33.3%	0.0%	0.0%

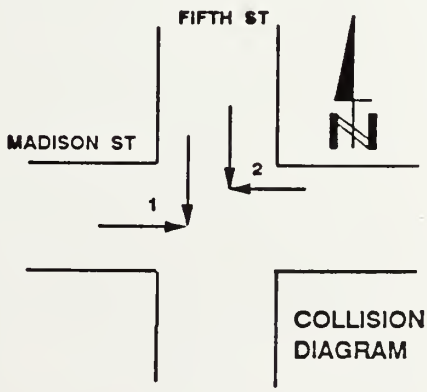


FIGURE NO.
VI-4.

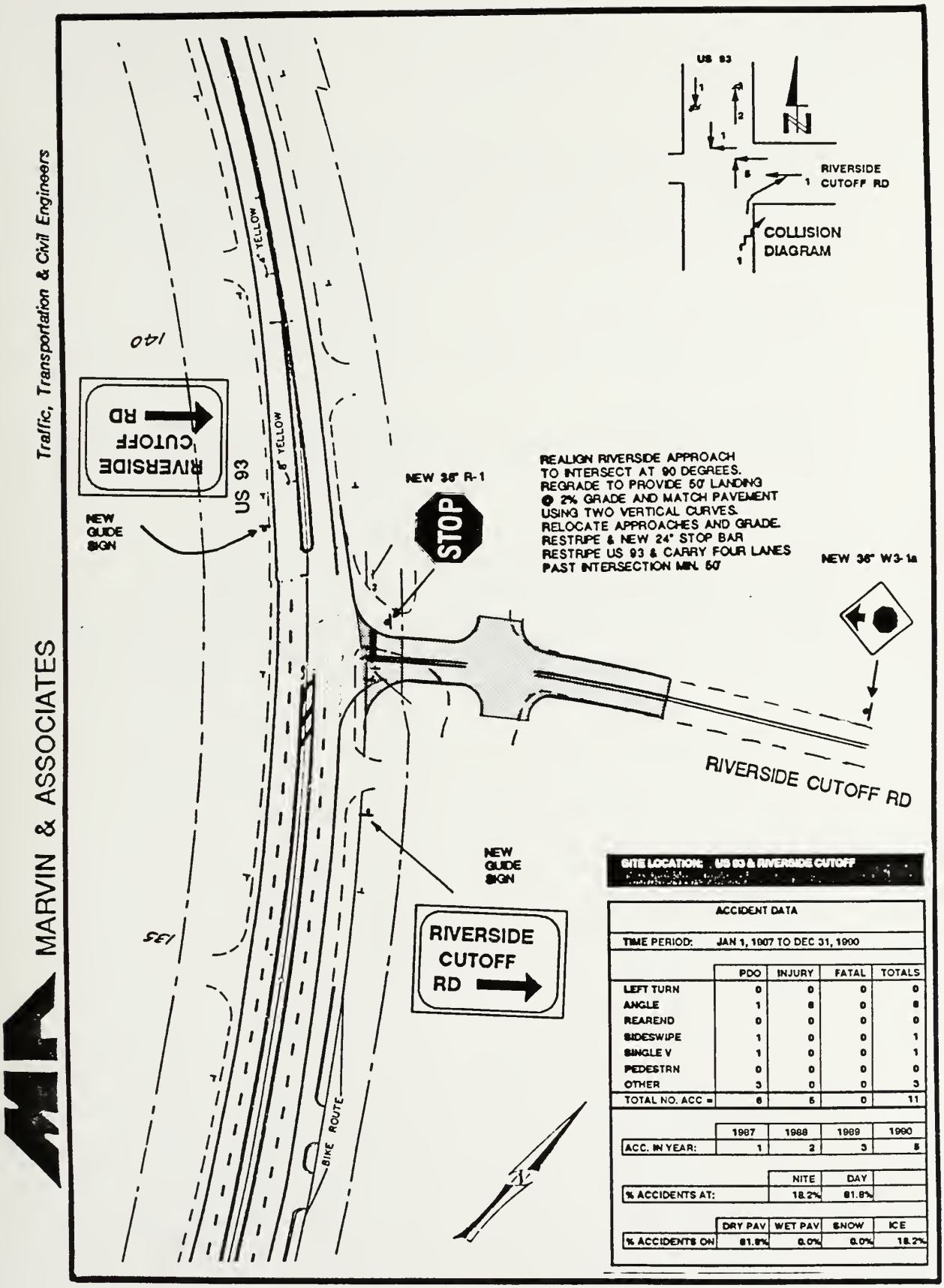
TITLE:
FIFTH & MADISON IMPROVEMENTS

5. RIVERSIDE CUTOFF ROAD & US 93

Figure VI-5. Is an extract of a MDOH signing and pavement marking as-constructed drawing. Pertinent features of the recommended improvements are shown thereon. Riverside Cutoff Road provides an alternate access between the east side of Hamilton and US 93 and connects directly to Old Corvallis Road, a north-south arterial. The intersection is located at the exact point that US 93 transitions from four lanes to two lanes. Riverside Cutoff Road intersects with a slight horizontal skew to US 93. The vertical alignment does not provide a landing on the same elevation as US 93. The road climbs at an approximate grade of 3-4% and intersects the shoulder of US 93. Approaches on either side of Riverside Cutoff Road are extremely wide and completely uncontrolled. US 93, south of the intersection, is a five lane road with the center lane accommodating two way opposing left turns. A bike path alongside the highway is also present. Signing consists of a 30" stop sign and bike path begins/ends signs.

There were 11 accidents reported in the four year period. Six of those accidents were angle accidents. Eight of the accidents were directly related to operations at the intersection, while the remaining three were collisions with deer. Severity of accidents was quite high with 5 of the 11 accidents producing injuries. Weather, road or light conditions did not have a significant bearing on the accident experience. Seven out of the 14 drivers involved, were from out of town. At least three of the drivers were older than seventy years. Most of the angle accidents occurred either at the noon hour or at the evening peak traffic hour.

Observations indicated that the intersection approach from Riverside Cutoff Road gives no physical clues to the location of the intersection because of the grade and wide approaches on either side. The angle of skew at the intersection is slight enough to ignore, but severe enough to require adjusting the vehicles position to avoid a blind spot. The most noticeable problem is the lane drop caused by the transition at the intersection. It almost appears as if the outer right lane is an exclusive turn lane, which may be a cause of some accidents involved in pulling from the stop into the path of vehicles in the right lane. In addition, northbound thru vehicle drivers on US 93 are occupied in trying to move to the inside lane at this point and are inattentive to vehicles that may be entering from the side road.



ACCIDENT DATA

TIME PERIOD: JAN 1, 1987 TO DEC 31, 1990

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	1	8	0	8
REAREND	0	0	0	0
SIDESWIPE	1	0	0	1
SINGLE V	1	0	0	1
PEDESTRN	0	0	0	0
OTHER	3	0	0	3
TOTAL NO. ACC =	6	5	0	11

	1987	1988	1989	1990
ACC. IN YEAR:	1	2	3	5

	NITE	DAY
% ACCIDENTS AT:	18.2%	81.8%

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	81.8%	0.0%	0.0%	18.2%

FIGURE NO. VI-5.

TITLE: RIVERSIDE CUTOFF RD & US 93 IMPROVEMENTS

The recommendations attempt to eliminate the worst of the observed problems. Realigning Riverside Cutoff Road to intersect US 93 at a 90 degree angle combined with regrading, will provide a landing that is visible upon a vehicles approach and will eliminate blind spots that can occur when a vehicle is skewed to the main road.

Narrowing and defining the side approaches will reduce side friction and eliminate sight restrictions caused by vehicles standing or operating within the side approaches.

Realignment of Riverside Cutoff Road will also allow the lane reduction transition to occur just beyond the intersection, which may help avoid confusion of the right lane utility and reduce the thru traffic's information load.

A new, larger stop sign and a new stop ahead sign will reduce the chances of Riverside Cutoff, drive-thru incidents. In addition, installation of new guide signs, on US 93, will provide drivers with information regarding the existence of a side street and aid those motorists intent on accessing Riverside Cutoff Road.

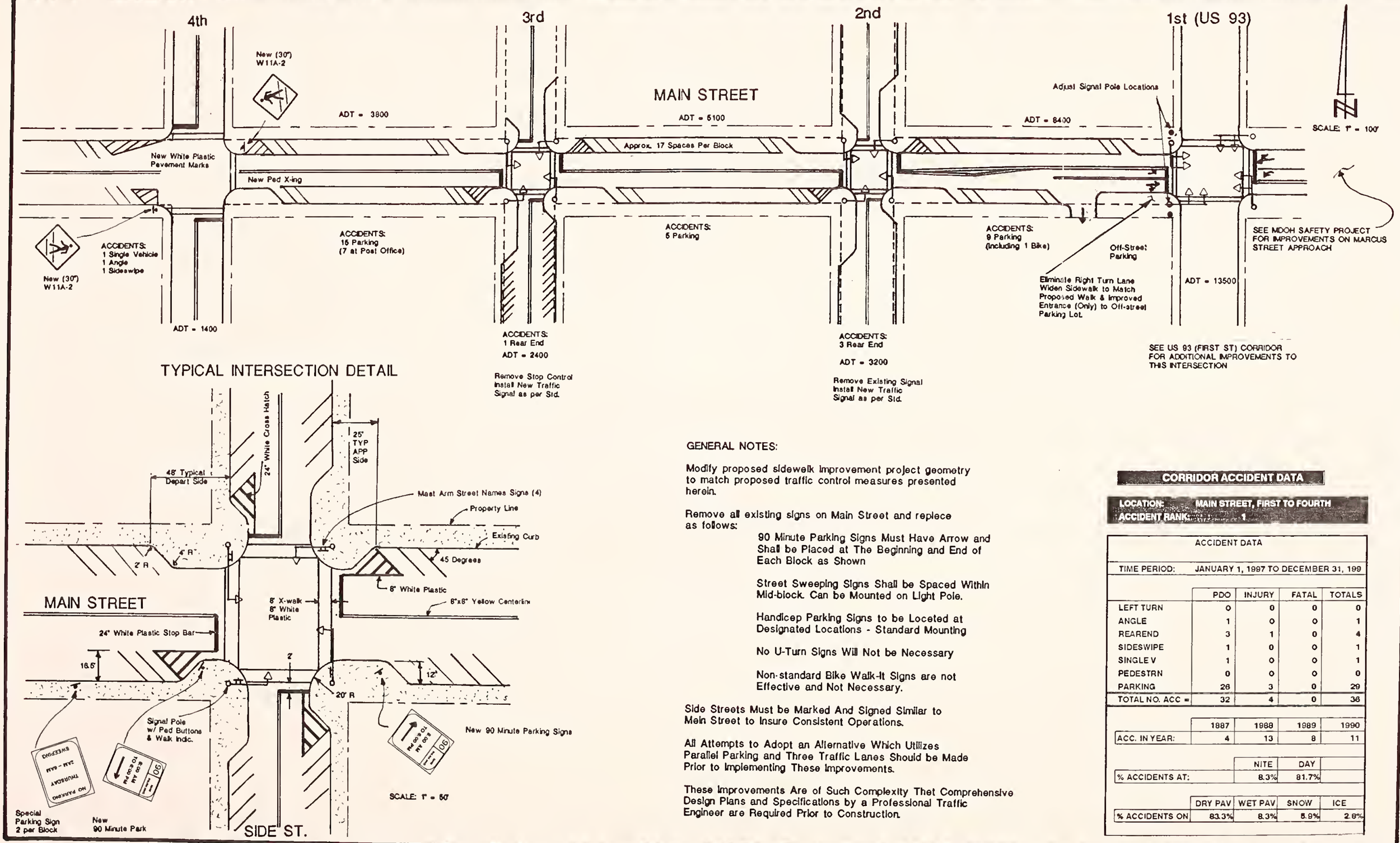
B. STREET CORRIDORS

The following section contains narrative descriptions and recommendations for street corridors within Hamilton which have experienced problems with accidents identified as being significant. These corridors also include individual intersections which were identified as being priority site locations in the accident screening process. Specific recommendations toward improving these corridors and drawings of improvements are presented when additional clarification of the improvements is considered necessary.

1. MAIN STREET, FIRST TO FOURTH

Main Street FAS (531) bisects the CBD and is the original street on which all commercial and retail businesses were located. The accident corridor section extends from one end of the CBD to the other in an east-west direction. Currently, Main Street is 76 feet wide form curb to curb. Intersecting side streets range from 56 feet to 60 feet in width. Angle parking is used on Main and all of the side streets. Existing traffic control consists of a relatively new signal at the intersection of Main and First (US 93); a span wire, fixed time signal at the intersection of Main and Second; an intersection beacon and four-way stop control at Third and Main; and a variety of parking and "No U-turn" signs along its length. The only pavement markings evident are at the intersection of Main and First. These markings are inlaid plastic and are in bad condition. Yellow painted parking restrictions near the intersections are also evident at some locations.

Accidents within this corridor involve both mid-block and intersection accidents, which are summarized in Figure VI-6. The corridor accident statistics do not include the First Street intersection, since it is covered in the US 93 Corridor section. A brief look at the accident statistics provides a fairly clear picture of the problems encountered. Twenty six of the 32 accidents occurring within a block distance, were accidents involving parking maneuvers. The others, rear end, angle and sideswipe accidents, may have been indirectly related to angle parking. A normal urban street with an ADT in excess of 8,000 and signalized intersections should experience a higher rate of rear end, angle and sideswipe accidents and very few parking accidents. The reason that typical accidents are not as high is probably because traffic flow is severely inhibited by parking maneuvers and thus potential conflicts are avoided by slow speeds.



TYPICAL INTERSECTION DETAIL

GENERAL NOTES:

Modify proposed sidewalk improvement project geometry to match proposed traffic control measures presented herein.

Remove all existing signs on Main Street and replace as follows:

- 90 Minute Parking Signs Must Have Arrow and Shall be Placed at The Beginning and End of Each Block as Shown
- Street Sweeping Signs Shall be Spaced Within Mid-block. Can be Mounted on Light Pole.
- Handicap Parking Signs to be Located at Designated Locations - Standard Mounting
- No U-Turn Signs Will Not be Necessary
- Non-standard Bike Walk-It Signs are not Effective and Not Necessary.

Side Streets Must be Marked And Signed Similar to Main Street to Insure Consistent Operations.

All Attempts to Adopt an Alternative Which Utilizes Parallel Parking and Three Traffic Lanes Should be Made Prior to Implementing These Improvements.

These Improvements Are of Such Complexity That Comprehensive Design Plans and Specifications by a Professional Traffic Engineer are Required Prior to Construction.

CORRIDOR ACCIDENT DATA

LOCATION: MAIN STREET, FIRST TO FOURTH
ACCIDENT RANK: 1

ACCIDENT DATA

TIME PERIOD: JANUARY 1, 1987 TO DECEMBER 31, 199

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	1	0	0	1
REAREND	3	1	0	4
SIDESWIPE	1	0	0	1
SINGLE V	1	0	0	1
PEDESTRN	0	0	0	0
PARKING	28	3	0	29
TOTAL NO. ACC =	32	4	0	36

	1987	1988	1989	1990
ACC. IN YEAR:	4	13	8	11

	NITE	DAY	
% ACCIDENTS AT:	8.3%	81.7%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	83.3%	8.3%	5.9%	2.8%

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FIGURE VI-6. MAIN STREET CORRIDOR

The most obvious solution to the existing accident problem would be to eliminate angle parking. If implemented, the street section could provide parallel parking and three lanes of traffic (center left turn lanes). Traffic flow would be improved immediately and street capacity would be made sufficient for anticipated volumes well into the future. However, removal of parking would reduce the total number of parking spaces and would create a very controversial situation among the CBD business owners. Currently, the downtown property owners are planning a sidewalk improvement project that would clean up the appearance of Main Street by constructing sidewalk flare outs at the intersections and providing street furniture and trees. One of the reasons for this project is to perpetuate angle parking by improving safety at the intersection areas. A recommendation to eliminate angle parking on Main Street would therefore, face stiff opposition and would probably not become an immediate reality. In light of that fact, an alternative recommendation was conceived and presented in Figure VI-6. This alternative utilizes the basic concept being planned by the downtown business owners and provides design criteria which should be used in design of that project.

The typical intersection detail shown in Figure VI-6., indicates the minimum parking setbacks and appropriate geometry necessary to insure the safety of vehicular and pedestrian traffic, when combined with angle parking. The parking setbacks provide for minimum stopping sight distance for vehicles traveling at 25 mph (150'). The curb and sidewalk flare outs at intersections would effectively reduce the probability of parking and other type accidents near the intersections, while reducing the time for pedestrian to cross the street. While not indicated on Figure VI-6., wheel chair ramps should be provided on all corners within the cross walk area to accommodate the aged and handicapped.

Traffic signing on Main Street is of particular concern. Many unnecessary signs exist at present and many signs are ineffective or would become ineffective when the proposed project is implemented. It is therefore recommended, that all of he existing signs be removed and salvaged if possible. New signs would consist of parking restrictions, special parking conditions, street name signs and warning signs as detailed in Figure VI-6. Large mast arm mounted street name signs on new signals are as vital as most regulatory signs in preventing accidents.

Pavement markings delineating the centerline, parking restrictions, crosswalks, stop bars and lane transitions should be installed as Inlaid plastic to provide longevity. Parking lane dividers may be painted (white) since restriping would not involve expensive machinery. Pavement markings will be a critical part of the satisfactory operation of this corridor.

Two new traffic signal installations are recommended as a part of this improvement project. The existing signal at Second does not meet any of the current standards for traffic signal operation and is probably more hazardous than no signal at all. The lack of pedestrian indications creates a guessing game as to when the light turned green and how much time there is left to cross the street. Existing signal timing allows a marginal amount of crossing time even when the start of green is noticed. New signals would provide proper pedestrian indications working off a fixed time coordinated system. Optimized timing would be enhanced by the shorter crossing distance created by the proposed end islands at the intersections.

The intersection at Third Street would warrant a signal based on minimum pedestrian volumes only. Traffic volumes are not sufficient for the signal and a four way stop could easily control traffic. However, four way stops are inherently dangerous at locations having even moderate pedestrian activity. Drivers attention to pedestrian activity is significantly reduced, when decisions regarding right of way are being considered. At most locations such as this, pedestrian attentiveness and agility usually minimizes actual accident experience. In this case, the aged pedestrian would have a distinct disadvantage and the potential for pedestrian accidents is great. Because of these facts, the pedestrian warrant for signals should be sufficient justification for including a new traffic signal at Third Street. It would be tied into the Main Street corridor signal system and the three signals could be coordinated on a fixed time cycle or as vehicle accuated signals, in the future.

All of the recommendations indicated above and in Figure VI-6. required a specialized knowledge of traffic systems, traffic pedestrian interaction, materials, hardware and construction techniques. Construction of the recommended improvements by unqualified personnel based on the improvement sketch, should not be attempted. This project is of sufficient complexity that design plans and specifications must be prepared and inspected by a professional traffic engineer.

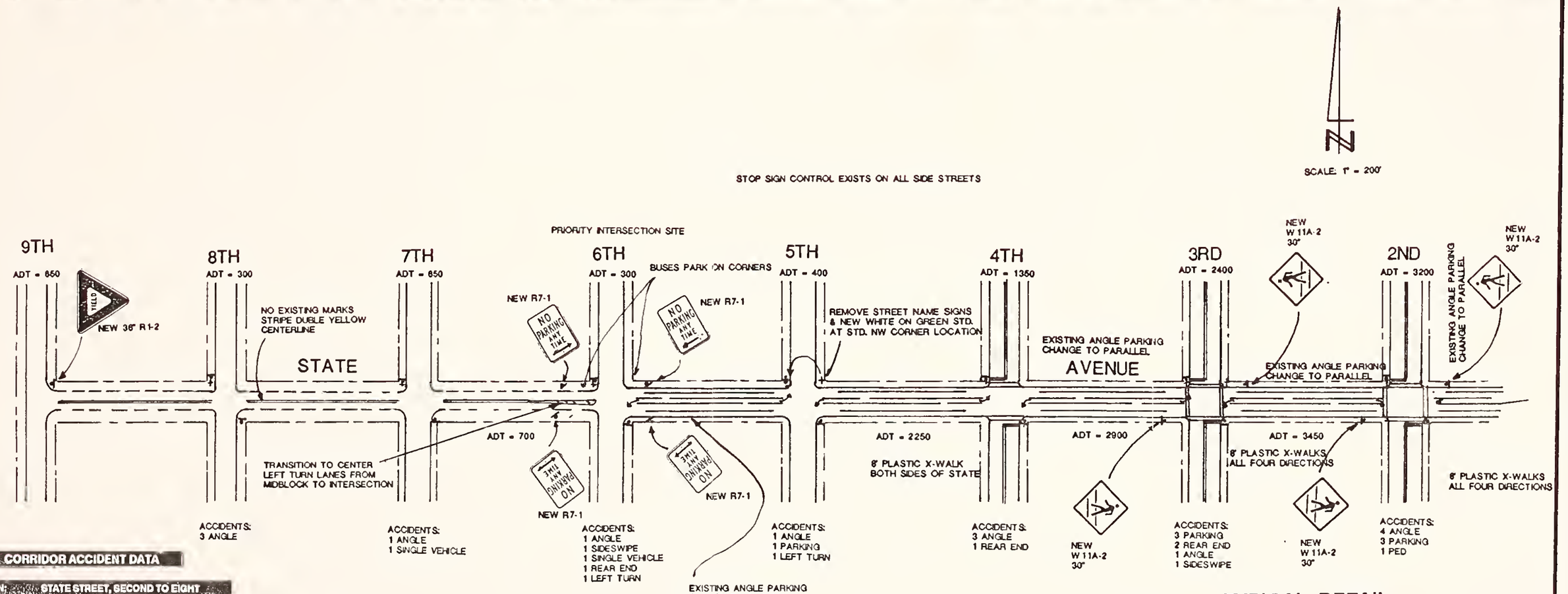
2. STATE STREET, SECOND TO EIGHT

State Street is another street that traverse the CBD in an east-west direction. It runs parallel to Main Street, one block south. Because of congestion on Main Street, State serves as an alternative east-west thru street and also serves localized circulation traffic in the CBD. The majority of State Street is 60 feet wide. It accommodates a mixture of angle and parallel parking. West of 6th Street, the paved section narrows and the curb section is dropped. Sidewalks exist along most of its length.

Figure VI-7. shows the accident experience along with proposed improvements along this corridor. There were 24 accidents in the four year study period and the predominant accidents were angle accidents (12). The second most common accident involved parking maneuvers, all of which involved angle parking. Four rear end accidents were associated with the side street stops. Most of the angle, sideswipe and rear end accidents are suspected to be indirectly related to angle parking, which inhibits sight distance at intersections. A pedestrian accident at the Second Street intersection was directly related to a parked car blocking sight distance.

State Street intersections with Second and Third Streets experience a moderate amount of pedestrian activity. It would be undesirable to change this intersections to a four-way stop, because of increased pedestrian accident potential. However, the crossings should be marked and signed to alert drivers of the conflict. Marking of the cross walks should not be attempted without first providing appropriate sight distance on each approach.

Traffic observations on State Street indicated that street side parking is currently under utilized with no more than 50 % of the spaces occupied during three observation periods. Because of the apparent lack of demand, conversion to parallel parking along the entire length of State Street should not create significant parking problems in the CBD. This action would enable implementation of the recommendations shown in Figure VI-7. State Street east of 6th Street could be marked as a three lane street, providing left turn lanes at intersections and in some cases, to mid-block approaches. Significant accident reductions along State could be realized by this action. However, other aspects the proposed project would be required for proper operation. Signing improvements would be required to insure proper installation and visibility of necessary signs. Pavement markings should be inlaid plastic to maintain a long useful life. Not



CORRIDOR ACCIDENT DATA

LOCATION: STATE STREET, SECOND TO EIGHT
ACCIDENT RANK: 1

ACCIDENT DATA

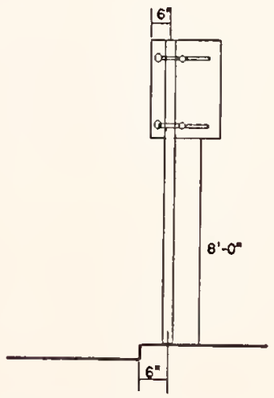
TIME PERIOD: JANUARY 1, 1987 TO DECEMBER 31, 199

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	2	0	0	2
ANGLE	12	2	0	14
REAREND	4	0	0	4
SIDESWIPE	2	0	0	2
SINGLE V	2	0	0	2
PEDESTRN	0	1	0	1
PARKING	6	1	0	7
TOTAL NO. ACC =	28	4	0	32

	1987	1988	1989	1990
ACC. IN YEAR:	6	6	10	10

	NITE	DAY	
% ACCIDENTS AT:	0.0%	100.0%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	71.9%	9.4%	12.5%	6.3%



CANTILEVER SIGN DETAIL

GENERAL NOTES:

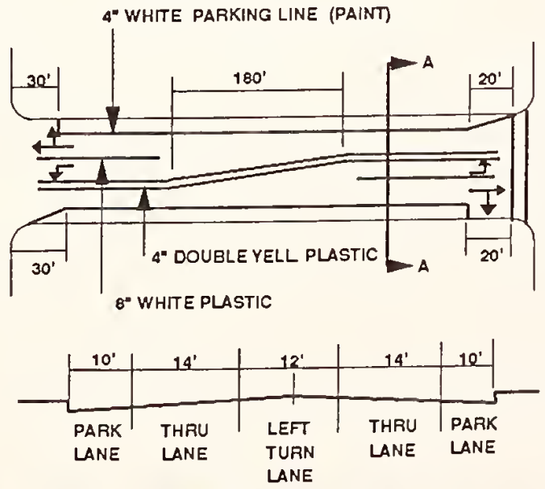
1. CHECK ALL SIGN MOUNTING HEIGHTS AND LOCATIONS AND ADJUST TO STANDARDS IF NECESSARY.

2. REMOVE EXISTING 30" R1-1 (STOP SIGNS) AT 2ND, 3RD AND 4TH STREETS AND REPLACE WITH 36" CANTILEVERED R1-1. (SEE DETAIL)

3. MARK ALL LEGAL PARKING RESTRICTIONS AT CORNERS AND X-WALKS WITH YELLOW CURB PAINT.

4. CHANGE STREET PARKING TO PARALLEL AND INSTALL PLASTIC PAVEMENT MARKINGS FOR CENTER LEFT TURN LANES. (SEE TYP SECTION)

TYPICAL DETAIL



SECTION A-A

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FIGURE VI-7. STATE AVENUE CORRIDOR

shown on the sketch are turn lane designation signs that may be required depending upon the final configuration of the left turn lanes, which may be continuous through each block or provided by transition bays.

All legal parking restrictions, as detailed in this report, should be marked by yellow paint on curbs or by signage In special cases. The intersection with 6th Street is commonly blocked by school buses waiting at the High School. In this case, signage and enforcement is required to keep the Intersection clear.

As in the case of the Main Street corridor, implementation of these improvements will require a more detailed plan prepared by a professional traffic engineer, to insure that proper standards are instituted and specific situations are accounted for.

3. THIRD STREET, PINE TO NEW YORK

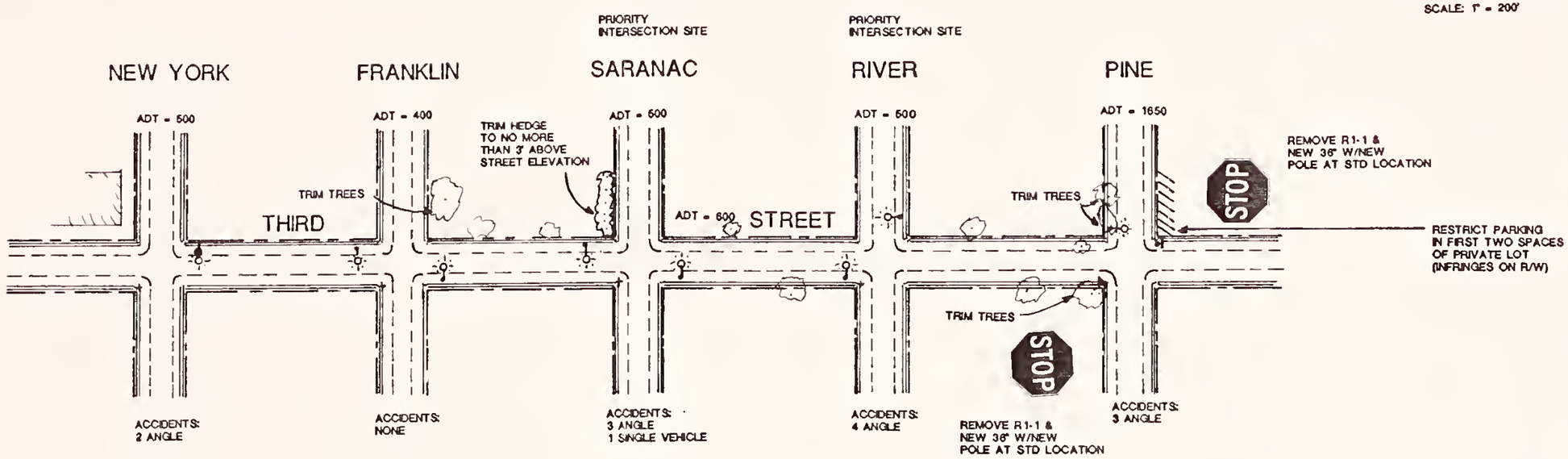
The Third Street corridor is the only one of the three problem corridors defined that is not within or traverses the CBD. Traffic volumes on this section of Third Street are approximately 600 ADT or greater. The only intersection of any consequence is Pine Street and Third Street, which is controlled by a stop sign. The most notable feature of Third Street is the City's method of paving a 30' strip down the middle of the 80' right-of-way, which leaves a parking area of gravel between the pavement and the curb or sidewalk, approximately 20' wide on each side of the street. Within this area, vehicles are parked in every imaginable manner. In some cases, they are parked directly in the corner of the intersection.

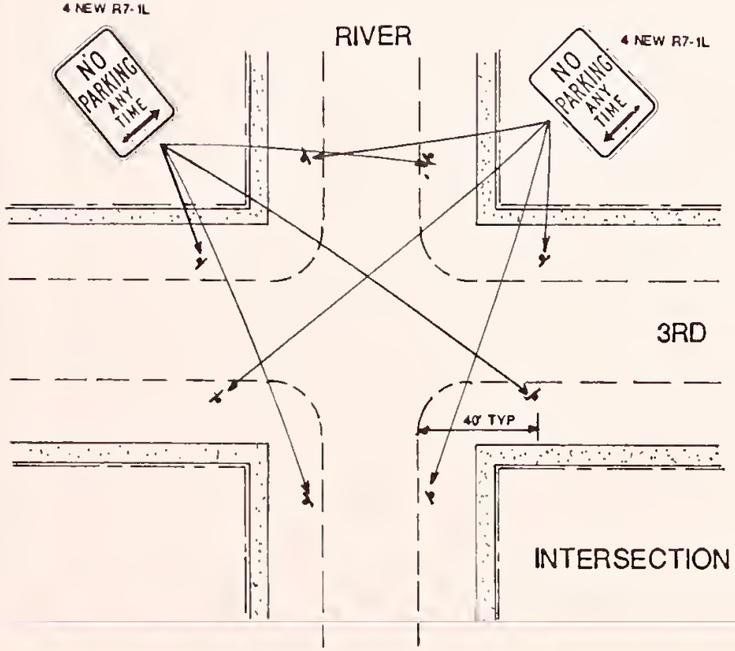
Of 13 accidents reported within this corridor, 12 of them were angle accidents. All accidents occurred at intersections. The majority of those occurred at Saranac and River Streets. Both of these intersections were identified as being priority intersection locations during the accident screening process.

During observation periods, very few permanent sight distances restrictions were noted. The improvement sketch, Figure VI-8., indicates the locations where sight restrictions exist. Trimming of low branches on tree and high branches on shrubbery should take care of those areas. A parking lot in the southeast corner impedes sight distance. The intersection clear zone should be protected by eliminating at least 2 of the corner spaces. The only other possible controls that could be instituted would be

REPLACE STREET NAME SIGN
ALL INTERSECTIONS

SCALE: 1" = 200'





INTERSECTION DETAIL

GENERAL NOTES:

1. PARKING ENFORCEMENT MAY BE REQUIRED AT THIS LOCATION TO PROHIBIT ANGLE PARKING AND PARKING CLOSER THAN THE LEGAL LIMIT TO THE INTERSECTIONS.

CORRIDOR ACCIDENT DATA

LOCATION: THIRD STREET, PINE TO NEW YORK
ACCIDENT BANK: 3

ACCIDENT DATA

TIME PERIOD: JANUARY 1, 1987 TO DECEMBER 31, 198

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	7	5	0	12
REAREND	0	0	0	0
SIDESWIPE	0	0	0	0
SINGLE V	0	1	0	1
PEDESTRN	0	0	0	0
PARKING	0	0	0	0
TOTAL NO. ACC =	7	6	0	13

	1987	1988	1989	1990
ACC. IN YEAR:	5	5	2	1

	NITE	DAY	
% ACCIDENTS AT:	30.8%	69.2%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	69.2%	7.7%	7.7%	15.4%

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FIGURE VI-8. THIRD STREET CORRIDOR

placement of larger stop signs at Pine Street and marking intersection parking restrictions as per state law and standards contained In the general recommendations section of this report. If residents of this area persist in parking perpendicular or at an angle, intersection restrictions must be also be increased. Periodic enforcement of the parking restrictions as described in the general recommendations section will be required to maintain the intersection clear zones. Neither function nor traffic volumes would warrant any other intersection controls in this area.

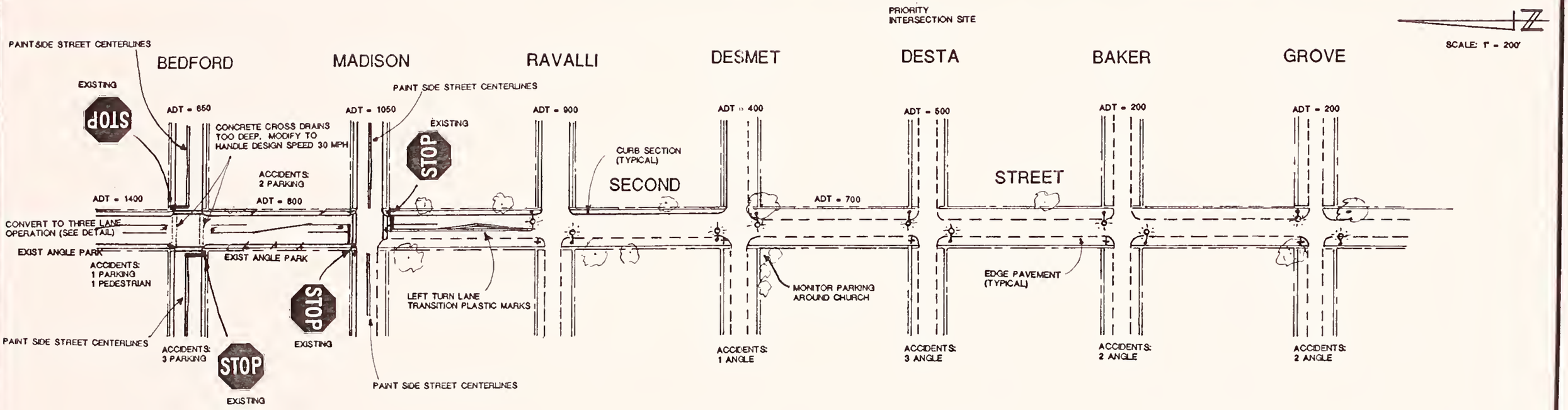
4. SECOND STREET, GROVE TO RIVER

Second Street is a local street which passes through the CBD, parallel and one block west of US 93. It carries a significant volumes of traffic within the CBD, primarily because of downtown circulation patterns. Outside of the CBD, traffic volumes are also higher than other area local streets. One reason for this is the influence of US 93. Local traffic on short trips use Second Street to go between north-south origins and destinations rather than enter US 93 because of delays encountered at uncontrolled US 93 intersections.

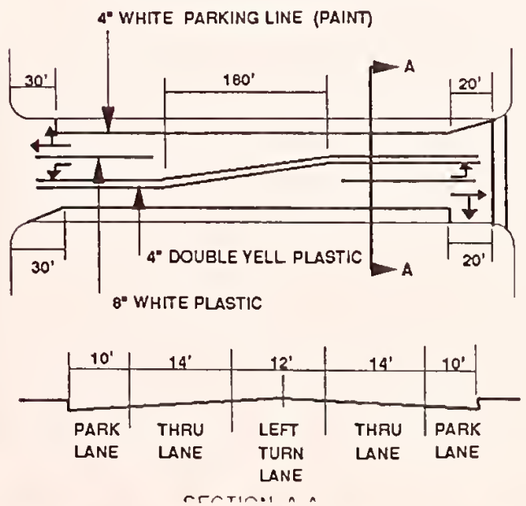
There were 49 accidents reported on this corridor during the four year study period. Only four types of accident were represented in these statistics: angle (16), rear end (1), pedestrian (1), and parking accidents (29). A summary of accidents by year indicates that the rate is continuing to increase, as traffic volumes increase. The predominance of parking accidents indicates that Second Street has the same problem as Main Street is experiencing with angle parking. Because of the narrower street the problem is slightly greater. Also, angle parking accidents occur in the intersection areas with more frequency than on Main Street.

Street geometry and traffic controls vary dramatically throughout the 0.9 mile length of this corridor as well as the number of accidents and accident types. Figure VI-9., represented on the following two sheets, indicates the street geometry, traffic volumes, accident data and proposed improvements. Because of the dramatic change in street character and traffic operations along the corridor, the type of improvements also vary through out its' length.

The section between Grove Street and Madison Street has a local street character similar to other residential street sections. Accidents in this area are confined to the



TYPICAL DETAIL



GENERAL NOTES:

1. PAINT CURBS YELLOW TO DELINEATE LEGAL RESTRICTIONS.

2. PARKING ENFORCEMENT MAY BE REQUIRED AT LOCATIONS WITHOUT CURB SECTIONS TO PROHIBIT ANGLE PARKING AND PARKING CLOSER THAN THE LEGAL LIMIT TO THE INTERSECTIONS.

3. CHECK AND ADJUST MOUNTING HEIGHT OF SIGNS.

4. CHECK AND ADJUST SIGN FACE ALIGNMENT OF SIGNS.

5. INSTALL NEW STREET NAME SIGNS AS PER STANDARDS COVERED IN THE GENERAL RECOMMENDATIONS SECTION.

6. CONVERT PARKING FROM ANGLE TO PARALLEL ON THE WEST SIDE BETWEEN MADISON AND STATE STREETS.

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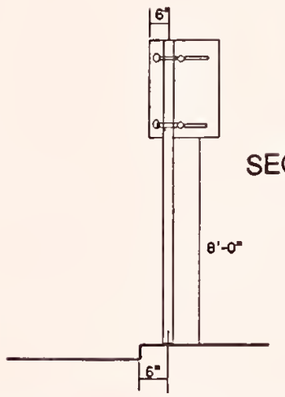
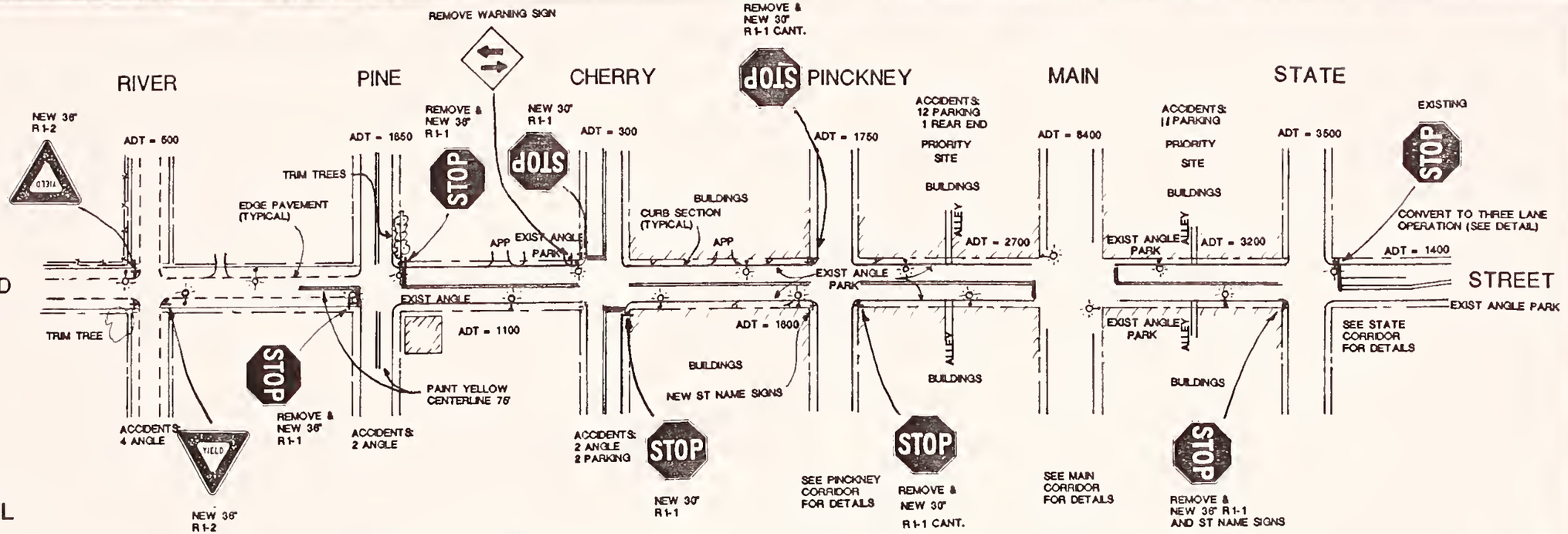
FIGURE VI-9. SECOND STREET CORRIDOR (Sheet 1 of 2)

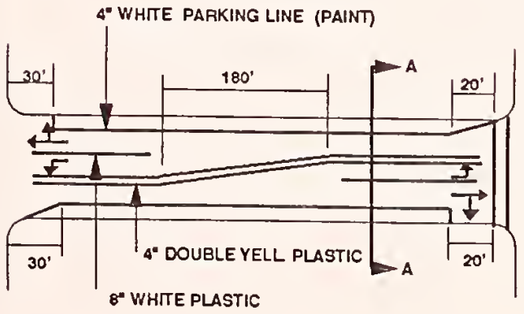


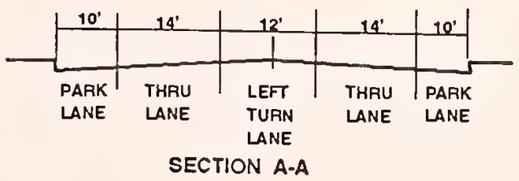
CANTILEVER SIGN DETAIL



SCALE: 1" = 200'

TYPICAL DETAIL





SECTION A-A

GENERAL NOTES:

1. PAINT CURBS YELLOW TO DELINEATE LEGAL RESTRICTIONS.
2. PARKING ENFORCEMENT MAY BE REQUIRED AT LOCATIONS WITHOUT CURB SECTIONS TO PROHIBIT ANGLE PARKING AND PARKING CLOSER THAN THE LEGAL LIMIT TO THE INTERSECTIONS.
3. CHECK AND ADJUST MOUNTING HEIGHT OF SIGNS.
4. CHECK AND ADJUST SIGN FACE ALIGNMENT OF SIGNS.
5. INSTALL NEW STREET NAME SIGNS AS PER STANDARDS COVERED IN THE GENERAL RECOMMENDATIONS SECTION.
6. CONVERT PARKING FROM ANGLE TO PARALLEL ON ALL STREETS NORTH OF CHERRY STREET.
7. MARK 4" DOUBLE YELLOW PLASTIC CENTERLINE AS SHOWN ON SECOND AND THE SIDE STREETS.
8. USE 24" WHITE PLASTIC STOP BARS WHERE SHOWN
9. USE SAME PARKING SIGN CONVENTION AS RECOMMENDED ON THE MAIN STREET CORRIDOR.

CORRIDOR ACCIDENT DATA

LOCATION: SECOND STREET, GROVE TO RIVER
ACCIDENT RANK: 4

ACCIDENT DATA

TIME PERIOD: JANUARY 1, 1987 TO DECEMBER 31, 199

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	11	5	0	18
REAREND	1	0	0	1
SIDESWIPE	0	0	0	0
SINGLE V	0	0	0	0
PEDESTRN	0	1	0	1
PARKING	29	2	0	31
TOTAL NO. ACC =	41	8	0	49

	1987	1988	1989	1990
ACC. IN YEAR:	11	10	13	15

	NITE	DAY	
% ACCIDENTS AT:	8.2%	91.8%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	77.6%	14.3%	2.0%	6.1%

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HAMILTON TRAFFIC OPERATIONS STUDY

FIGURE VI-9. SECOND STREET CORRIDOR (Sheet 2 of 2)

intersections. Because intersection areas are relative clear of obstructions, parking practises along this section are believed to be a contributing factor in accident experience. Marking and enforcement of parking regulations need to ensure clear vision zones. One area in the southwest corner of Second and Desmet has an extension of a parking lot abutting the pavement around the street corner. Since the building on the corner is a church, obstructions probably only occur during special times of the week.

The section of Second Street between Madison and State Streets has angle parking on the west side and parallel parking on the east side. Since this is an area used for persons access the cities municipal buildings, their is normally a high turnover rate in parking stalls and pedestrian activity. Observations at different periods indicate that this area has numerous conflicts and potentially hazardous vehicle and pedestrian movements occurring. Accident experience has been rather low in this area, probably because the activity level is great enough to create caution in most drivers. Because of the congestion and potential for serious accidents, it is recommended that parking on the west side of the street be modified to parallel and the street section remarked to accommodate three traffic lanes, providing left turn lanes at the intersections. This is one area where it may be advisable to construct off street parking to replace lost spaces. If proper parking restrictions were implemented along these blocks, at least 8 spaces would be lost, even if angle parking were to remain.

Of all stop controlled intersections in Hamilton, the section between Madison and State Streets causes the most confusion. The assigned right-of-way control is proper according to traffic volumes, however a deep cross drain on either side of Bedford Street makes it difficult to maintain travel speed along Second. Vehicles slow, to near stop condition, to cross the drainage swail and Bedford traffic, waiting at the stop signs, interpret this maneuver as an indication that it is a four way stop. The result is a noticeable amount of stutter starts and near accidents. In this case, it is recommended that the cross pan be reconstructed to provide a higher, more comfortable speed for vehicles crossing. This situation occurs at several other intersections in Hamilton and should be evaluated further.

The section of Second Street from State to Cherry Street is very similar to Main Street except that it is approximately 20 feet narrower. The downtown sidewalk project would add an additional 2' to each side of the street on either side of Main Street, but judging from accident experience on Main Street, that effort will provide

minimal relief from parking accidents or capacity restrictions. As with Main Street, angle parking would be very difficult to remove because of the political implications involved. However, the primary recommendation would necessarily be conversion of angle to parallel parking and designation for three traffic lanes. Knowing that this recommendation would have little chance of implementation within the foreseeable future, the alternative recommendation would be to improve the safety of the street, as much as possible, by implementing legal parking restrictions. The Main Street sidewalk project will contribute significantly to reducing accidents on Second Street at or near the intersection with Main. Additional parking restrictions around the alley entrances (20' from adjacent property lines) would also be required because of the high number of accidents involving alley and parking maneuvers. In addition to parking setbacks, curb sections at the corners are square. This not only presents liability to the City for slashed tires and dented rims, it creates an unnatural turning movement; makes it difficult to properly delineate parking restrictions; and limits access to the aged and handicapped.

Existing signing along this section of Second Street consists of parking control signs and stop signs, as well as one warning sign, the intent of which cannot be determined. Many parking signs will be relocated when parking restrictions are implemented. Signs which specify time limits and street sweeping should be located at standard locations, as noted in the Main Street improvements. Handicapped and other special signs may be placed for individual spaces as required. All signs should be checked for mounting height and alignment to the street. Several existing signs are directed parallel to the street and cannot be read until it is too late. New stop signs as recommended in Figure VI-9., sheet 2, should be a standard cantilever mount, to project them as close to the street as practical.

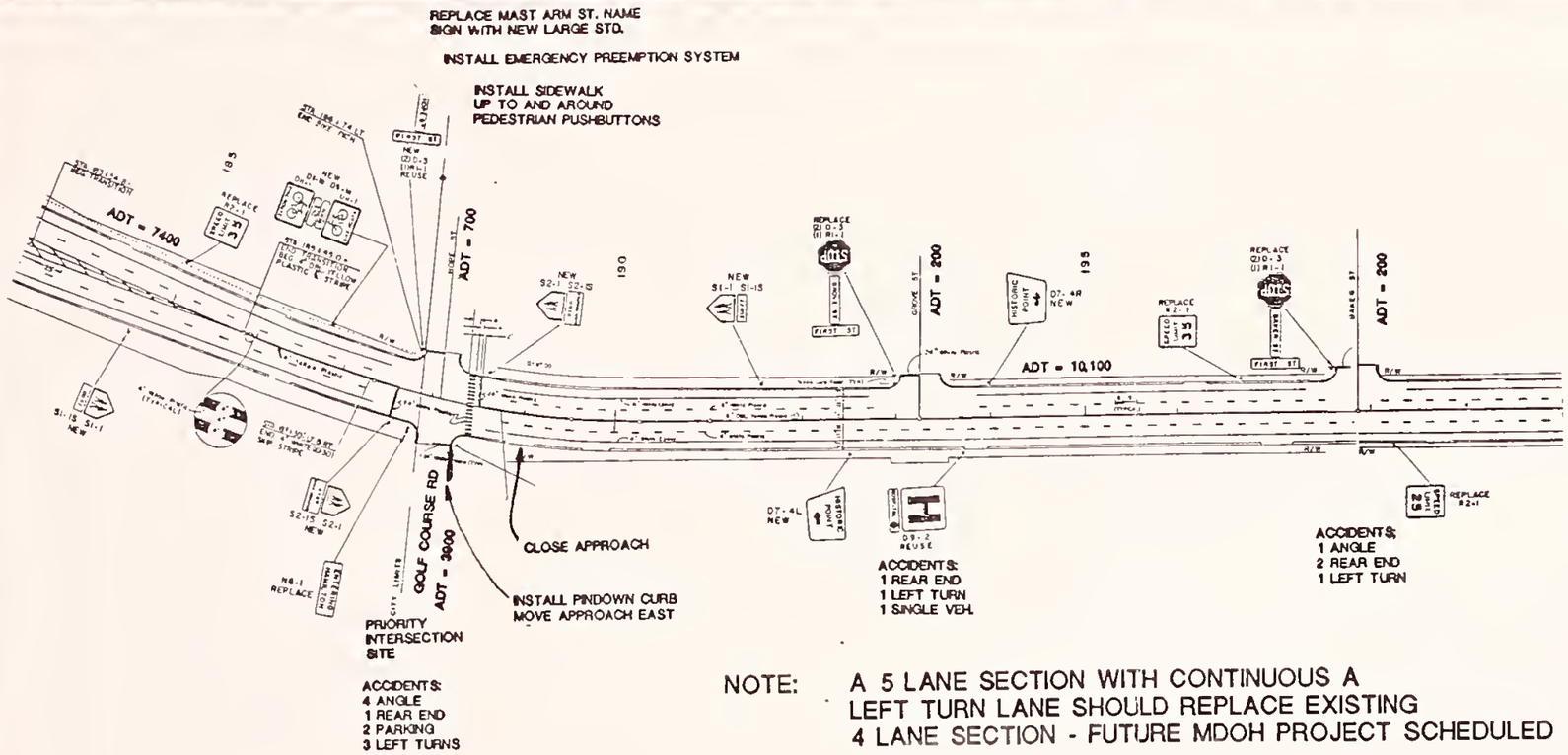
Pavement markings should be installed as noted in the improvements sketch, since guides for vehicle alignment, in an area with angle parking and higher traffic volumes, is important. The street centerline aids drivers entering and leaving parking spaces by providing a line of perspective from which to judge vehicle positioning.

The new stop sign at Cherry Street is necessary because of accident experience and consistency along the through route. The yield sign at River is recommended as a first level of effort to change past accident experience. No obvious sight restrictions exist at this intersection, other than some low tree branches. Future monitoring of this intersection will reveal if stop control or other form of traffic device is necessary.

5. FIRST STREET (US 93), GOLF COURSE RD TO PENNSYLVANIA

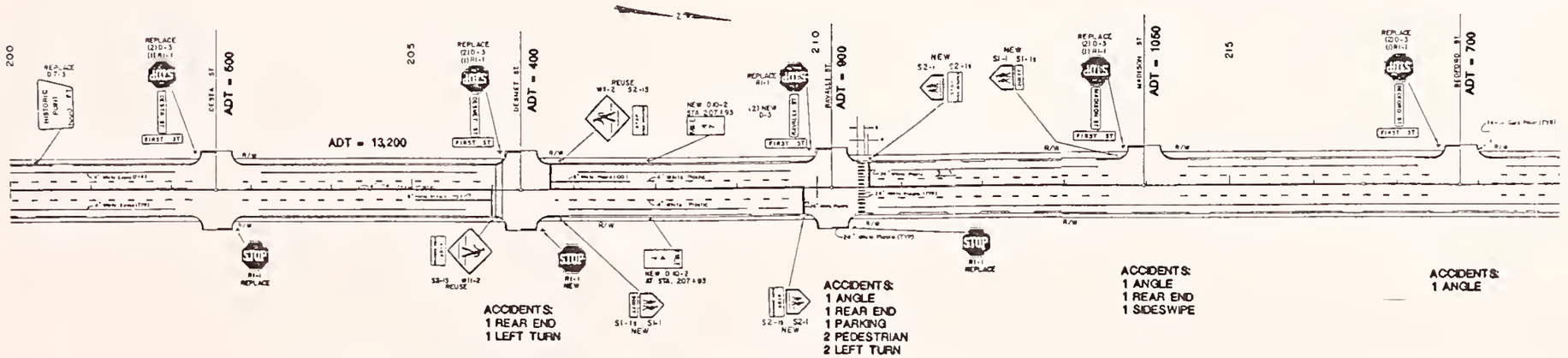
US 93 is the main corridor through the City of Hamilton and as a state primary route, it carries a wide range and variety of traffic. Vehicle types range from small compact cars to triple trailer trucks, along with everything in between. Vehicle trips lengths range from one block to several hundred miles. The drivers of these various vehicles all have different perspectives on the proper operating procedures for this street. When a trucker, who is an hour behind schedule on a 500 mile trip, is driving behind an 80 year old grandmother going to the grocery 5 blocks away, conflicting expectations often occur. In this 1.2 mile corridor section, expectations were violated 130 times over a four year period, in the form of auto accidents. Figure VI-10., sheets 1 and 2, is an extract from the MDOH project which reconstructed US 93 to its present condition. The accident locations and statistics for this corridor are shown thereon.

Several intersections along this corridor were singled out as priority accident locations during the intersection screening process. The intersection of Golf Course Road and US 93 was one of them. Upon analysis of this intersection, it was discovered that almost all of the accidents occurred prior to the installation of a traffic signal last year (1990). Insufficient data exists to evaluate the effect of the signal, but it appears that significant improvements will be realized. Even though the signal is new, some problems were noted at this location, dealing directly with the aged driver. Access to pedestrian push buttons is restricted because the sidewalk stops at least 10 feet short of the poles on which the buttons are mounted. Uneven surface access to the buttons may be a major obstacle to an elderly person. The street name signs mounted on the mast arms are too small for most people to notice and thus too small for the elderly to read. There was no emergency preemption detection system installed with the signal. While Hamilton does not currently have the emitter equipment for their fire trucks, it is an item they would desire if the signals were equipped with the system. In addition, an operational problem was noted at this intersection which proved to be significant, since two left turn and two angle accidents were related to it. The approaches to a convenience store with gas pumps are located in the northeast corner of the intersection. Vehicles access the approaches from a southbound directions while vehicles in the inside lane are stopped waiting to turn left onto Golf Course Road. Northbound traffic, which is traveling in excess of 35 mph, cannot see a vehicle turning into the approach from behind the stopped vehicles and several near misses, in a short period of time, were noted. It is recommended that the southern most



NOTE: A 5 LANE SECTION WITH CONTINUOUS A LEFT TURN LANE SHOULD REPLACE EXISTING 4 LANE SECTION - FUTURE MDOH PROJECT SCHEDULED

US 93 (FIRST STREET)



NOTE: MULTI LANE PED-XINGS ARE POTENTIALLY HAZARDOUS WITHOUT SIGNAL. CROSSING GUARDS ARE NEEDED FOR SCHOOL AGED CHILDREN.

CORRIDOR ACCIDENT DATA

LOCATION: US 93, GOLF CRSE RD TO PENN. ST.
ACCIDENT RANK: 6

ACCIDENT DATA

TIME PERIOD: JANUARY 1, 1987 TO DECEMBER 31, 199

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	17	7	0	24
ANGLE	23	10	0	33
REAREND	31	8	0	39
SIDESWIPE	7	1	0	8
SINGLE V & OTHE	8	3	0	11
PEDESTRN	1	6	0	7
PARKING	7	1	0	8
TOTAL NO. ACC =	94	36	0	130

	1987	1988	1989	1990
ACC. IN YEAR:	26	44	34	26

	NITE	DAY	
% ACCIDENTS AT:	18.5%	81.5%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	74.6%	13.1%	4.6%	7.7%

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HAMILTON TRAFFIC OPERATIONS STUDY

FIGURE VI-10. US 93 CORRIDOR (SHEET 1 of 2)

PRIORITY INTERSECTION SITE

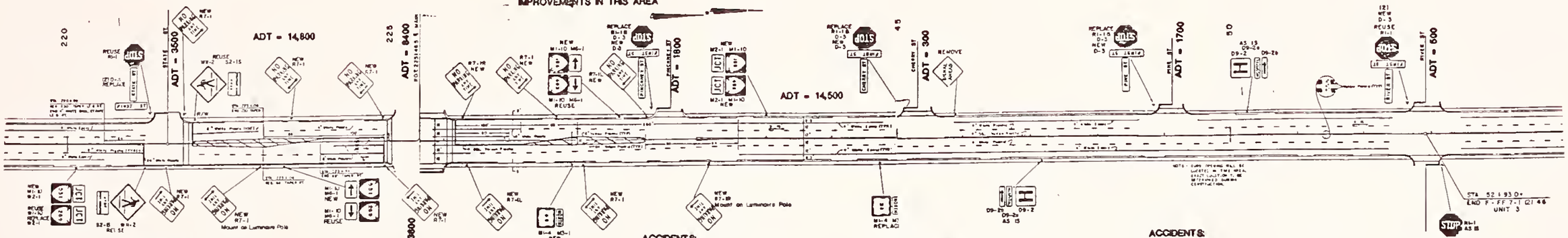
SEE INTERSECTION DETAIL FIGURE VI-11.

SIGNAL TENTATIVELY WARRANTED FIRE STATION ACCESS ROUTE TO BE REVIEWED BY MDOH

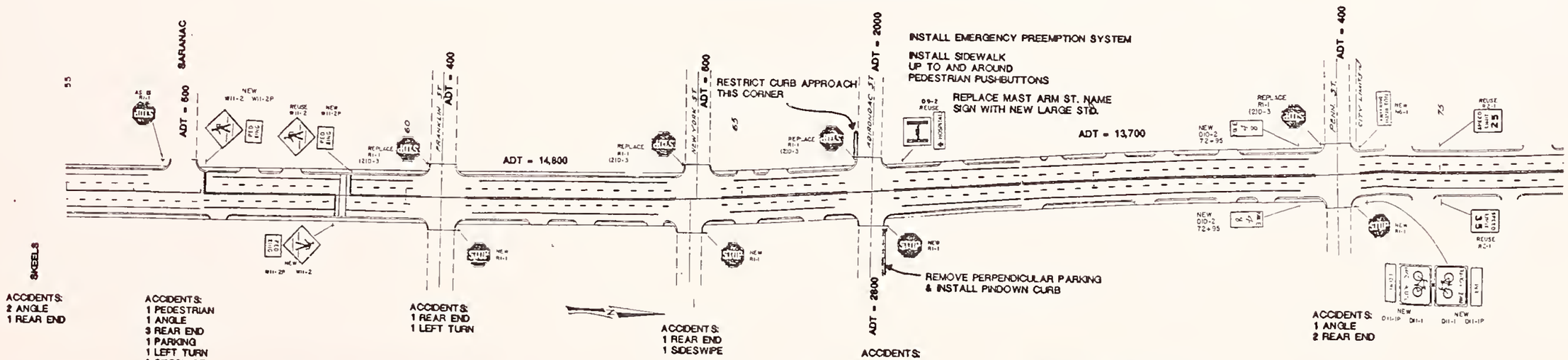
SIGNAL TENTATIVELY WARRANTED TO BE REVIEWED BY MDOH

SEE REPORT SECTION ON LOCAL CONCERNS FOR IMPROVEMENTS IN THIS AREA

SIGNAL TENTATIVELY WARRANTED TO BE REVIEWED BY MDOH



NOTE: A 5 LANE SECTION WITH CONTINUOUS A LEFT TURN LANE SHOULD REPLACE EXISTING 4 LANE SECTION - FUTURE MDOH PROJECT SCHEDULED



US 93 (FIRST STREET)

PRIORITY INTERSECTION SITE

MIDBLOCK ACCIDENTS BETWEEN CHERRY ST. & K-MART ENTRANCE:
1 PEDESTRIAN
3 ANGLE
2 REAR END
1 PARKING
1 LEFT TURN
1 SIDESWIPE
2 OTHER

NOTE: MULTI LANE PED-XINGS ARE POTENTIALLY HAZARDOUS WITHOUT SIGNAL. CROSSING GUARDS ARE NEEDED FOR SCHOOL AGED CHILDREN.

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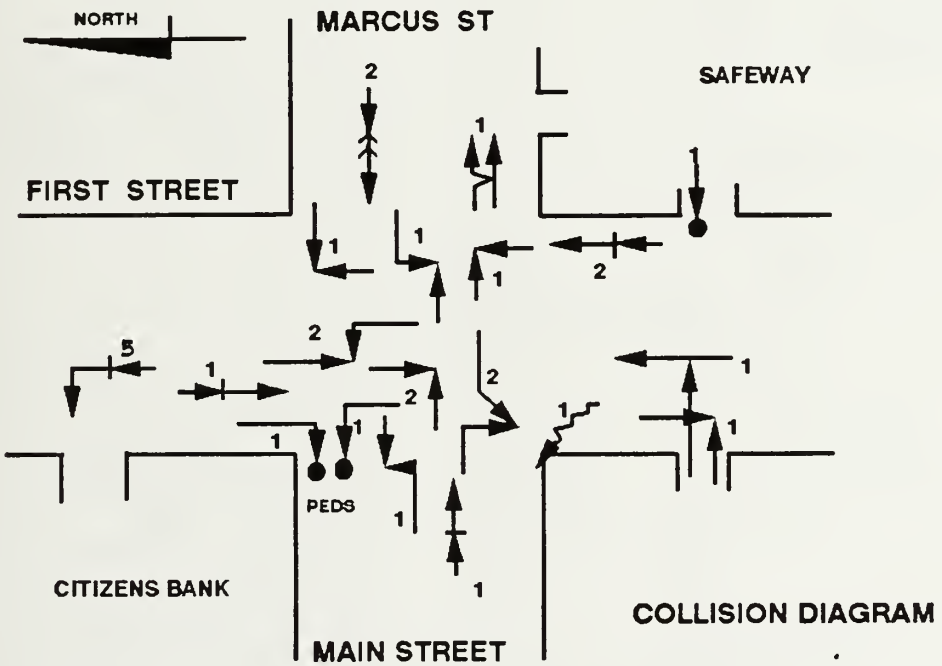
HAMILTON TRAFFIC OPERATIONS STUDY

FIGURE VI-10. US 93 CORRIDOR (SHEET 2 of 2)

approach to the store be closed and the approach onto Golf Course Road should be moved further east, away from the intersection area.

Another priority intersection along US 93 is at Main Street. In a four year period, there were twenty seven accidents at this intersection. The sketch presented below, indicates the wide variety of accidents that have occurred at this intersection. Some of the accidents, actually occurred at approaches near the intersection, such as the five left turn accidents involving the citizens bank approach. Also of particular concern were two pedestrian accidents. This intersection had a particularly high severity with 9 of 27 accidents producing injuries.



A significant number of accidents are directly or indirectly related to bad lane control and access control on the Marcus Street approach to the intersection. MDOH currently has a project being designed to eliminate many of these particular problems. During the analysis and evaluation of this intersection, it became apparent that there were other factors in the safety of this intersection, which were not being addressed by the MDOH project. Figure VI-11. is a sketch of the improvements being proposed through this study. The left turn to the Citizens Bank can be improved by eliminating the left turn from Main Street, by transitioning to a new left turn bay at Pinckney Street. Additional details regarding this improvement can be found in the Pinckney Corridor and the Local Concern section of this report.

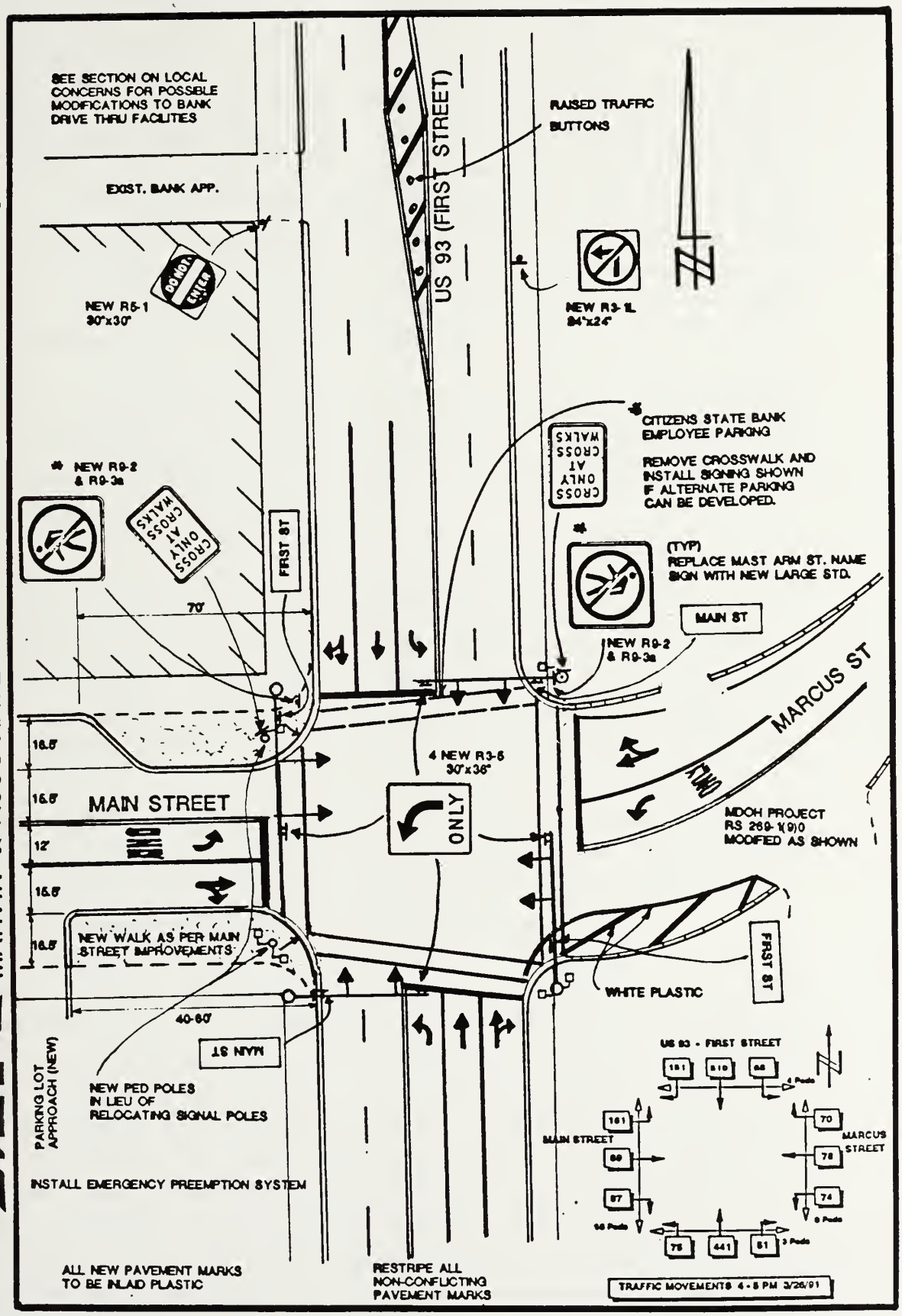


FIGURE NO.
VI-11.

TITLE:
US 93 - MAIN ST. IMPROVEMENTS

The new Main Street Sidewalk project could be considered an ideal time to correct a problem at the Main Street approach to the intersection. The three approach lanes on Main, to US 93, are not needed in terms of capacity and the short storage area, often blocked by parked vehicles, is almost useless. At the same time, geometry of the intersection is such that opposing left turn drivers from Marcus cannot see right turning vehicles. It is recommended that the right turn be eliminated and replaced with a bulb island as shown. This would conform to the remainder of Main Street; provide a much shorter pedestrian crossing; and provide improved sight distance.

Because of the crossing angle, long distance and lack of sidewalk east, it would be ideal if the pedestrian crossing on the north side of Main be eliminated. However, Citizens State Bank employee parking is located in the northeast corner and removal of the crossing would not be practical at this time.

MDOH's safety project should be modified slightly by eliminating the proposed painted island in the middle of Marcus Street, so that the left turn lane can line up directly with the opposing left. This will eliminate hidden vehicles. Also, the twenty eight foot opening for eastbound traffic on Marcus is visually too wide for the average vehicle and invites sideswipe accidents. While the extra area is needed for turning trucks, cross hatching the additional area to delineate proper vehicle paths would help.

Mast arm mounted lane control signs are an obvious need at this intersection. During observation periods, approximately 30 % of the vehicles on the Marcus Street approach made inappropriate movements from the lane they occupied. Some violation of lane usage was also noted at all of the other approaches also.

Another priority intersection on US 93, was the intersection with Adirondac Street. Analysis of this intersections indicated that it was similar to Golf Course Road, since a signal had been installed at the same time. It too, has experienced a significant improvement because of the signal, but it also has similar deficiencies. Access to the pedestrian buttons has to be improved; new larger street name signs are needed; and an emergency preemption system is desired. A particularly troublesome location was noted which cannot be ignored for long, at the current rate of traffic growth. A restaurant in the northeast corner of the intersection has perpendicular parking marked to the edge of the road. Conflicts, potential safety problems and capacity problems associated with this condition are too numerous to list. It is recommended that the parking be removed and pin down curb installed to eliminate future concerns. Similarly, an

approach in the southwest corner of the intersection Is too close to the intersection and should be relocated.

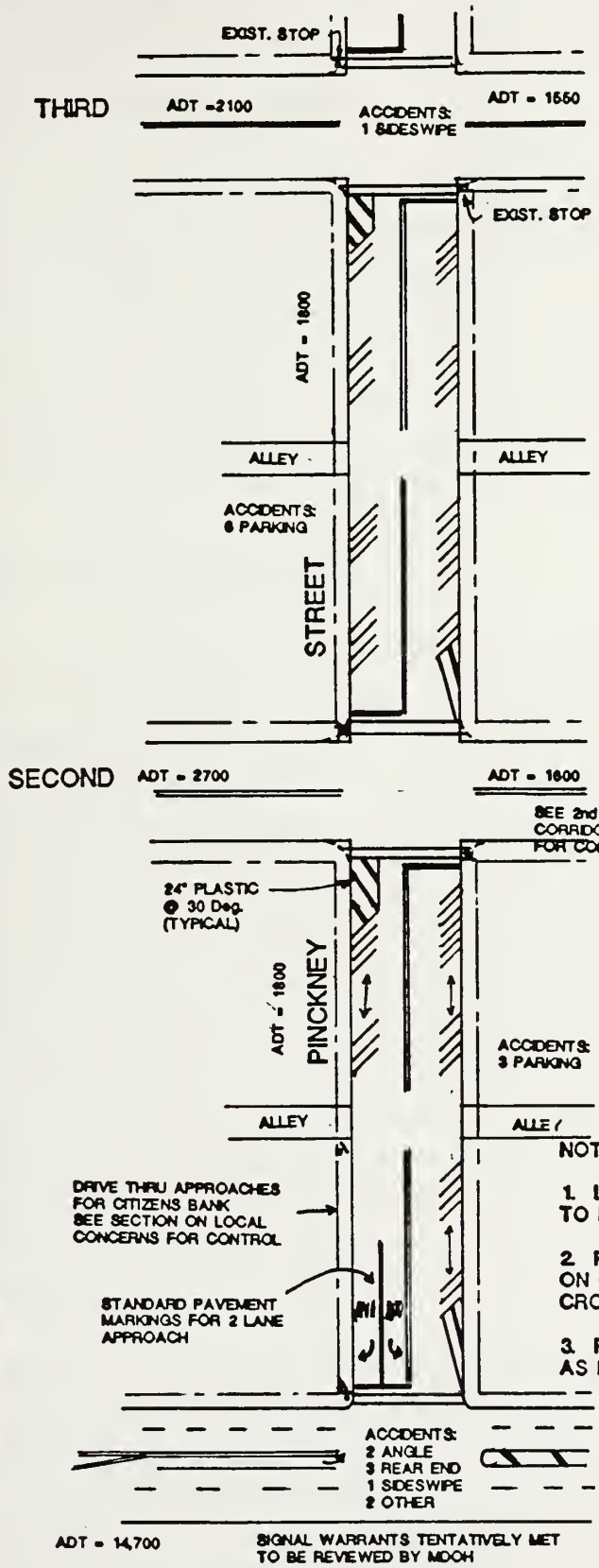
During analysis of this corridor, traffic signal warrants were computed for major intersections with US 93. Based on this analysis, three locations had warrant values that marginally met warrants for signalization. Those intersections were at State Street, Pinckney Street and Pine Street. The most critical of these streets was State Street. Since this street provides access to the Hamilton Fire Department and a fire signal was an initial consideration in the study analysis, it appears that a signal at this location would be the most desirable of the three intersections. The other two locations should be considered for future study and review by MDOH.

Problems on the remainder of US 93 could be mitigated to some degree by converting the entire corridor to five lane operation, with a continuous left turn lane. It is reported that MDOH is currently in the process of developing a project to accomplish this task. If not, all efforts should be made to begin planning this type of project.

6. PINCKNEY, FIRST TO THIRD

Pinckney Street is a local east-west street, which in the corridor area, passes through the CBD and serves as on of the primary circulation streets. As with all streets in the CBD, Pinckney Street has angle parking along its length. A major traffic generator, Citizens Bank drive-thru window facilities and bank parking lot is in the southwest corner of the US 93 - Pinckney intersection. Considerable problems have occurred on Pinckney and on Main Street with regard to the location and operation of this facility. Recommendations specifically dealing with this problem are made in the "Local Concern" section of this report.

Accidents, other than those occurring at the bank access points and at the intersection with US 93, are primarily parking accidents or parking related accidents. As with other areas of the CBD, elimination of angle parking would be a prime recommendation. However, realistic continuation of angle parking must be considered. Figure VI-12., indicates the necessary work required to continue angle parking with increased safety. All parking restrictions at intersections and alleys must be marked and enforced. Centerline striping should be marked along with stop bars and cross walks. as shown.



SCALE: 1"=100'

CORRIDOR ACCIDENT DATA

LOCATION: PINCKNEY, FIRST TO THIRD
ACCIDENT RANK: 6

ACCIDENT DATA

TIME PERIOD: JANUARY 1, 1987 TO DECEMBER 31, 199

	PDO	INJURY	FATAL	TOTALS
LEFT TURN	0	0	0	0
ANGLE	1	1	0	2
REAREND	3	0	0	3
SIDESWIPE	2	0	0	2
SINGLE V & OTHE	2	0	0	2
PEDESTRN	0	0	0	0
PARKING	9	0	0	9
TOTAL NO. ACC =	17	1	0	18

	1987	1988	1989	1990
ACC. IN YEAR:	9	2	5	2

	NITE	DAY	
% ACCIDENTS AT:	5.6%	94.4%	

	DRY PAV	WET PAV	SNOW	ICE
% ACCIDENTS ON	72.2%	16.7%	5.6%	5.6%

NOTES:

1. LEGAL PARKING RESTRICTIONS TO BE PAINTED YELLOW ON ADJACENT CURBS.
2. PAVEMENT MARKINGS TO BE PLASTIC ON CENTERLINE, LANE LINE, STOP BARS, CROSSWALKS & WORDS/SYMBOLS AS SHOWN.
3. PAINT 45 DEGREE PARKING SPACES AS REQUIRED.

FIGURE NO. VI-12

TITLE: PINCKNEY CORRIDOR, 1ST TO 3RD

C. AREAS OF LOCAL CONCERN

Early in the stages of this study, local officials and department heads met with the consultant to discuss specific problems and concerns that they had regarding traffic operations in Hamilton. During that meeting, a list of problem areas was drawn and added to the scope of study. Subsequent to that meeting, the study progressed and within the framework of the analysis and evaluation, almost every local concern had also surfaced as a problem area identified through either accident screening or operational analysis. The following section presents reference to improvements recommended in other sections of the report and specific recommendations as required.

1. NORTH-SOUTH THRU STREETS

Local officials were quite concerned that thru street designations would change as a result of this study and cause problems with local residents, who have an ingrained habit of considering north-south streets, thru streets. All of the designated stop streets in Hamilton were found to be appropriate for existing conditions. Additional control was added to some problem intersections. Coincidentally, in all cases the stop or yield control was placed on the east-west street. The unofficial designation or thru streets was not noticed during observation periods. It seemed as if drivers went through intersections without attempting to yield or slow in the east-west direction equally with those in the north-south direction. On local streets, traffic volumes are usually low enough that control is not needed unless there are permanent sight restrictions. The right hand law is the rule of the road and should be understood by everyone with a drivers license. When traffic volumes increase on one leg of an intersection, drivers become accustomed to the thru route, by repetitive experiences, and act accordingly. Stop signs are for drivers unfamiliar with the prevailing conditions.

2. DEVELOPMENT GROWTH AROUND 10TH STREET

One of the fastest growing and newest areas within the Hamilton City Limits is in an area on the west side of town, north of Main Street, and east of the river. Primary access to this area is from 10th Street and from Pine Street. This area, which also contains the hospital, has experienced the construction of large condominiums and apartment buildings. Past construction has witnessed increases in traffic volumes on 10th Street Main Street and Pine Street. Since there is a significant amount of vacant land in this area, the City of Hamilton is concerned with the impact of additional

growth. As a part of this study, a rudimentary analysis was completed to determine the impact of growth on future traffic volumes and the probable effect on the existing streets.

The area of concern was divided into five sections, which would have varied access requirements. All of these areas have vacant land available for development, the total of which is estimated to be approximately 50 acres. Using aerial photos, a probably density factor was determined for the highest density development currently existing, which was approximately 17 dwelling units (apartments) per acre. Highest residential single family density in Hamilton is approximately 5 Dwelling units (homes) per acre. Rates for trip generation based on the 5th Edition of an ITE report "Trip Generation" for apartments and other residential type dwelling were applied to different development densities, to determine a range of trips that could possibly be generated from this area. It was determined that between 2,400 and 4,400 additional trips could be generated from this land area, in the future.

From this point, trips were assigned to the street system based on origin and destination assumptions and least travel time criteria. The result was an estimate of future traffic volumes on area streets, based on full density development adding to existing traffic, as presented below:

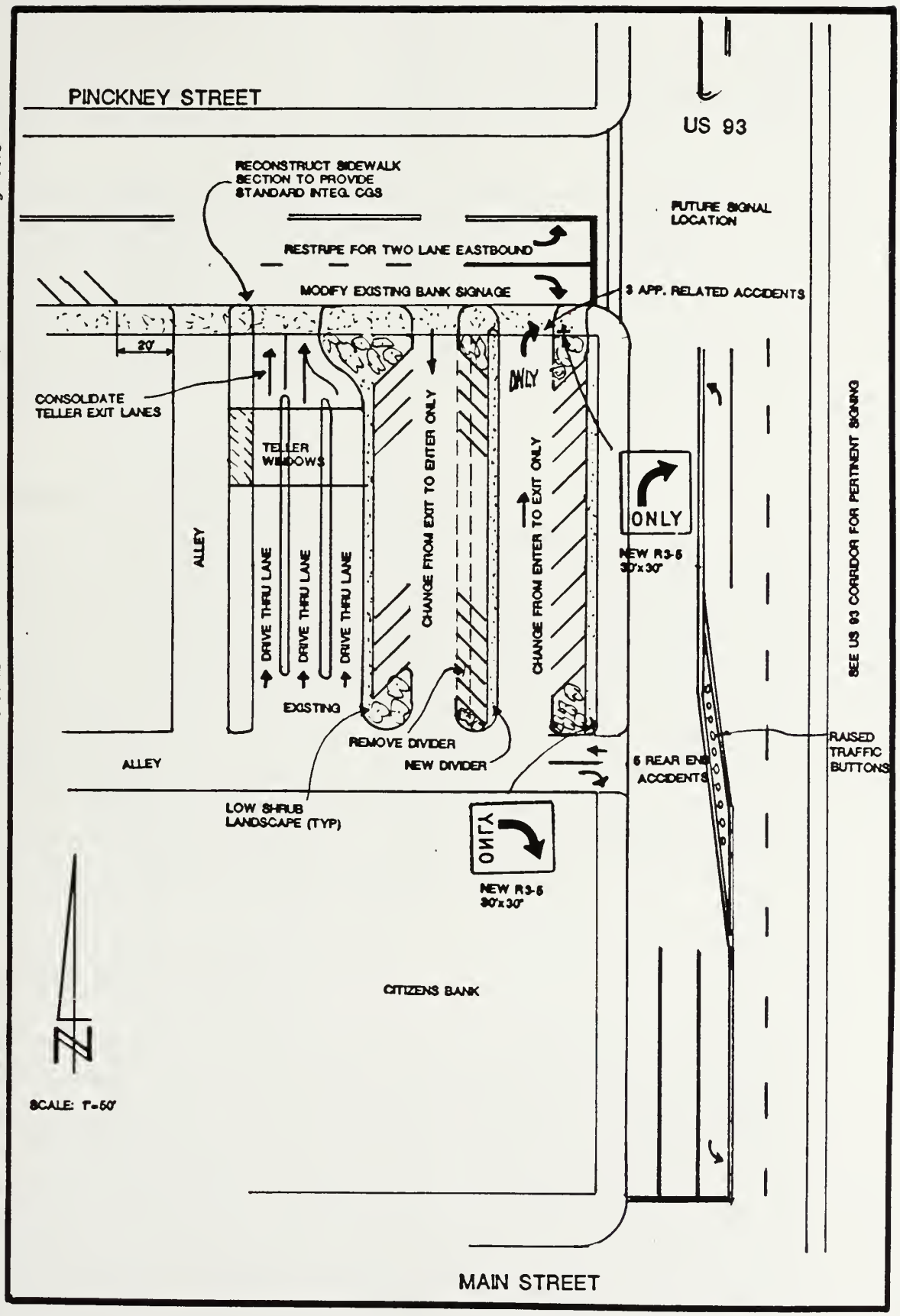
	Existing ADT	Full Develop. ADT Range	Total Future ADT Range
Tenth Street	1500	1100 to 2000	2600 to 3500
Eight Street	300	400 to 750	700 to 1050
Pine Street	1300	350 to 650	1650 to 2300
Adirondac	1700	1000 to 1900	2700 to 3900

The most significant impact from continued growth, up to full development, would be the probable need for signalization of Pine and US 93 and Main and Tenth Street. Volume increases would require improved surfacing and traffic control along Pine Street; lane control markings and improved signing along Tenth Street; and upgrading of Adirondac from Tenth to US 93.

3. CITIZENS STATE BANK OPERATIONS

The Citizens State Bank Is located west of US 93 between Main Street and Pinckney. Drive thru window tellers are located adjacent to the alley, running north-south In the northwest portion of the block. The bank parking lot is located next to the drive thru lanes. Currently access to the lot and drive thru lanes is gained from an alley at mid block on US 93 and from a series of approaches on Pinckney Street. Five rear end accidents have occurred at the US 93 approach and 3 approach related accidents have occurred at the eastern most approach, on Pinckney. The eastern most approach on Pinckney currently operates as an entrance only and two rows of angle parking are served by that approach. To the west of these rows, is a single row of parking angled to the north, which has an exit only to Pinckney. West of the parking rows are three drive thru lanes, all of which have individual exits to Pinckney. A great deal of effort was apparently expended in channelizing the parking and drive thru traffic circulation patterns. Unfortunately, little thought was given to conflicts with street traffic. Ideally, a main entrance on Pinckney with an exit onto US 93, where vehicles queued on the street would not interfere with access movements, would have been a better design. To redesign the circulation would require moving the teller windows, which may not be a solution readily acceptable to the bank.

Figure VI-13. presents an alternative layout which would greatly improve street access, safety and efficiency without substantially changing the existing lot layout. This concept would involve reversing the direction of access and parking in the lot. An existing concrete divider would have to be relocated; new island dividers constructed and the sidewalk on Pinckney reconstructed. Raised traffic buttons on US 93 to discourage left turns into the alley approach would be required along with signing previously recommended. Vehicles southbound on US 93 could still use the alley entrance while two entrances could be used on Pinckney: the alley for eastbound vehicles and the center approach for westbound vehicles. The middle approach on Pinckney would be far enough away from the intersection that eastbound vehicles queued at the US 93 intersection would not block the approach. Separate turn lanes on Pinckney would be needed to insure that longer queues did not form. The exit at the eastern approach would have to be a right turn only exit. The three teller lanes should be merged beyond the windows so that no more than two vehicles are ever lined up on the approach to Pinckney. The undulating sidewalk on Pinckney, across the existing approaches, provides steep inclines which are extremely hazardous to pedestrians,



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Traffic, Transportation & Civil Engineers

FIGURE NO. VI-13.

TITLE: CITIZENS BANK CIRCULATION IMPROVEMENTS

especially elderly people. In addition, all of the lot circulation and access signing would have to changed to accommodate the revised operations.

The above recommended improvements cannot be considered an Ideal drive thru access design, but it would be less expensive than reconstructing the entire lot. As a local government, the City of Hamilton may not be able to dictate changes to the internal layout of this property, at this point in time. However, the City can prohibit unsafe movements entering and exiting the property. The City should pursue discussions with the bank and form a spirit of cooperation that will benefit the traveling public and the bank's customers.

4. INTERSECTION OF STATE AND NINTH STREETS

City officials have been concerned with the proper control of the intersection of State with Ninth Street. It is a tee intersection that is near the junior high school and athletic field. The majority of traffic is on State Street. There are large groups of high school aged persons, who periodically walk and run along the roadway, while accessing the athletic field. Most of the concerns at this location are addressed in the School Improvements" section of this report. It is recommended that a yield sign be posted on the State Street leg of the tee, for two reasons: 1. Traffic volumes differences are not high nor significantly different and 2. Thru traffic on Ninth would not expect to yield to traffic from the single leg of a tee. When traffic volumes increase at this intersection a different control scheme should be considered.

5. GROCERY STORE ROUTES

Not normally considered as a part of a planned urban street system, routes to the grocery are usually left up to the discretion of each individual person. In Hamilton, a safe route to the grocery or department store can be frightening prospect to many of the elderly people residing in that community. At present, there are no choices. A resident must enter and drive on US 93 to access a supermarket and other commercial businesses. The elderly are especially susceptible to mishaps on high volume multi lane streets and the simple act of going to the grocery can become an ordeal. Construction of alternative routes to existing commercial areas may be the only solution to this problem, in the foreseeable future. For residents living on the south end

of town, It is possible to reduce travel on US 93 by driving on side streets as far as Adirondac Street. From that point, the only way to get to supermarkets and the K-Mart store, is to drive on US 93.

The City of Hamilton has had concerns in this regard for some time and has attempted to gain right-of-way fro an access road to the north by extending Lyndale Avenue. As a part of this study, they requested the consultant to determine the best location for the alternative route. A very basic model was used to assign shopping access trips to alternative locations for this route. The two locations considered was an extension of Lyndale and an extension of Belmont Avenue. The connection of these extension would be to an existing street stub-out south of the K-Mart store, which has immediate access to K-Mart and land south of the street. It was determined that Second Street and Fourth Streets would be the major cross town streets carrying traffic to the alternate access route. Approximately 400 vehicles per day would use a route along Belmont while over 500 vehicles per day would utilize a Lyndale route. In addition, the Belmont route would intersect Adirondac Street at midblock. When future traffic volumes increase, Fourth Street to Belmont traffic flows could be significant and this traffic would encounter a jogged alignment. In the case of Lyndale, Second Street would have increased traffic. The offset between Second and Lyndale is less than a hundred feet. It would be much easier to straighten this alignment and control a single intersection. Also, the cost of constructing a connection from Lyndale to the street stub-out would be approximately half of what the Belmont connection would be, provided that the right-of-way costs were equal. However, an extension of Lyndale would go through an existing water pump station and the required alignment would not allow a future connection to US 93, north of the existing commercial area. Because of these conditions, it is recommended that the City pursue the Belmont connection (see Figure VI-14).

6. EMERGENCY VEHICLE ROUTES

The City expressed concern regarding emergency vehicle operations on the street system. Specifically, the concern was for fire trucks entering US 93 from State Street and the lack of emergency preemption on the existing signals. According to analysis on the US 93 corridor, the intersection of State and US 93 would warrant a traffic signal based on peak hour warrants. If MDOH would opt not to install a signal because of progression or other reason, it would seem prudent for Hamilton to request a signal on the basis of emergency fire operations.

FIGURE NO.	TITLE:
VI-14	ALTERNATIVE SHOPPING AND US 93 CONNECTION ROUTES

7. DOWNTOWN PARKING

The subject of parking downtown has been discussed extensively within other previous sections of this report. From a transportation standpoint, there is no question that angle parking is hazardous and inefficient. From the viewpoint of downtown businesses, it provides as many parking spaces as can be squeezed out of the public streets. With every parking space lost, a potential customer or client is lost to the suburban shopping mall. This same problem exists in every city in the United States and it will continue to worsen as Hamilton grows. Transportation consultants can only offer recommendations with regard to this problem. The decision rests with local policy makers.

There were 99 accidents (7 injury type) directly involving parking maneuvers in the CBD area of Hamilton in a four year period. Many more accidents were caused indirectly by parking and sight distance restrictions. According to the latest national statistics, each property damage accident has an economic cost of $ 1,500 while injury accidents cost $ 11,000 on the average. If only the accidents directly related to parking were considered, angle parking in the CBD had cost Hamilton $ 215,000 between 1987 and 1990 or approximately $ 54,000 per year. If one of those accidents would have been a fatality, it would have added $ 150,000 to the bill, if the cost of a life can really be measured.

As an alternative, the city could consider forming a downtown parking district and issue bonds to construct off-street parking at strategic locations. A parking lot which could hold in excess of 100 vehicles (the approximate number of spaces lost to parallel parking) would require an entire city block. If pieces of land could be obtained that are not commercially viable, an equivalent parking lot could be constructed for approximately $ 500,000. Savings from accident experience would pay for the investment in less than ten years. An intensive parking study would be better able to identify the most feasible alternatives available and it is recommended that the City of Hamilton consider undertaking such a study in the near future.

8. FIRST STREET (US 93) PROBLEMS

Most of the concerns expressed by local officials have been addressed within the US 93 Corridor section of this report. The only subject not previously discussed is the speed limit. During operational observations careful attention was given to the pace

speed along US 93, in order to determine if there were any areas that the posted limit was grossly in error. From the physical appearance of the street and roadside environment, some of the limits on either side on town appeared to be too low, but the pace speed of vehicle queues seemed to be within the proper range.

With regard to the number of speed limit signs, there is a definite shortage of 25 mph signs within the City. Considering the number of entering streets, there should be additional signs for each direction on each side of Main Street and on each side of Adirondac. This would amount to a total of 8 new speed limit signs, spaced equally.

9. FOURTH & MAIN, POST OFFICE OPERATIONS

The post office is the hottest spot in town, as far as traffic activity is concerned. The post office is located in the northeast corner of Fourth & Main Streets. There is angle parking in front of the building and on the other side of Main Street. Also, in back of the building there is a large empty parking lot with a vehicle drop box for the convenience of motorists.

A one hour count was taken in the middle of the afternoon. Parking in front of the post office has an extremely high turn-over rate, with 51 vehicles entering and 47 vehicles exiting approximately 10 parking spaces, in one hour. At this rate, the disruption to thru street traffic is significant. If a measured time of 17 seconds to leave a space and 3 seconds to enter is used, parking activities consume 16 minutes of every hour available for traffic on the street. Reduction in street capacity is greater than 26 percent and accidents are common. In addition, overflow traffic utilizes parking on the other side of the street and the drivers then jay walk to the post office. Meanwhile, the rear parking lot is only 15% occupied and only 15 vehicles used the drop boxes.

Recommendations to improve this situation, rely on the proposed sidewalk improvement project. Figure VI-15. illustrates the proposed improvements. It is recommended that parking in front of the post office be eliminated entirely and replaced with a curb side, drop box lane. The lane should be divided from the street with a concrete barrier island and boxes, spaced as shown, should be installed to speed service. The drop lane is shown as 17' wide which is the minimum required for vehicles to pass side by side within the lane.

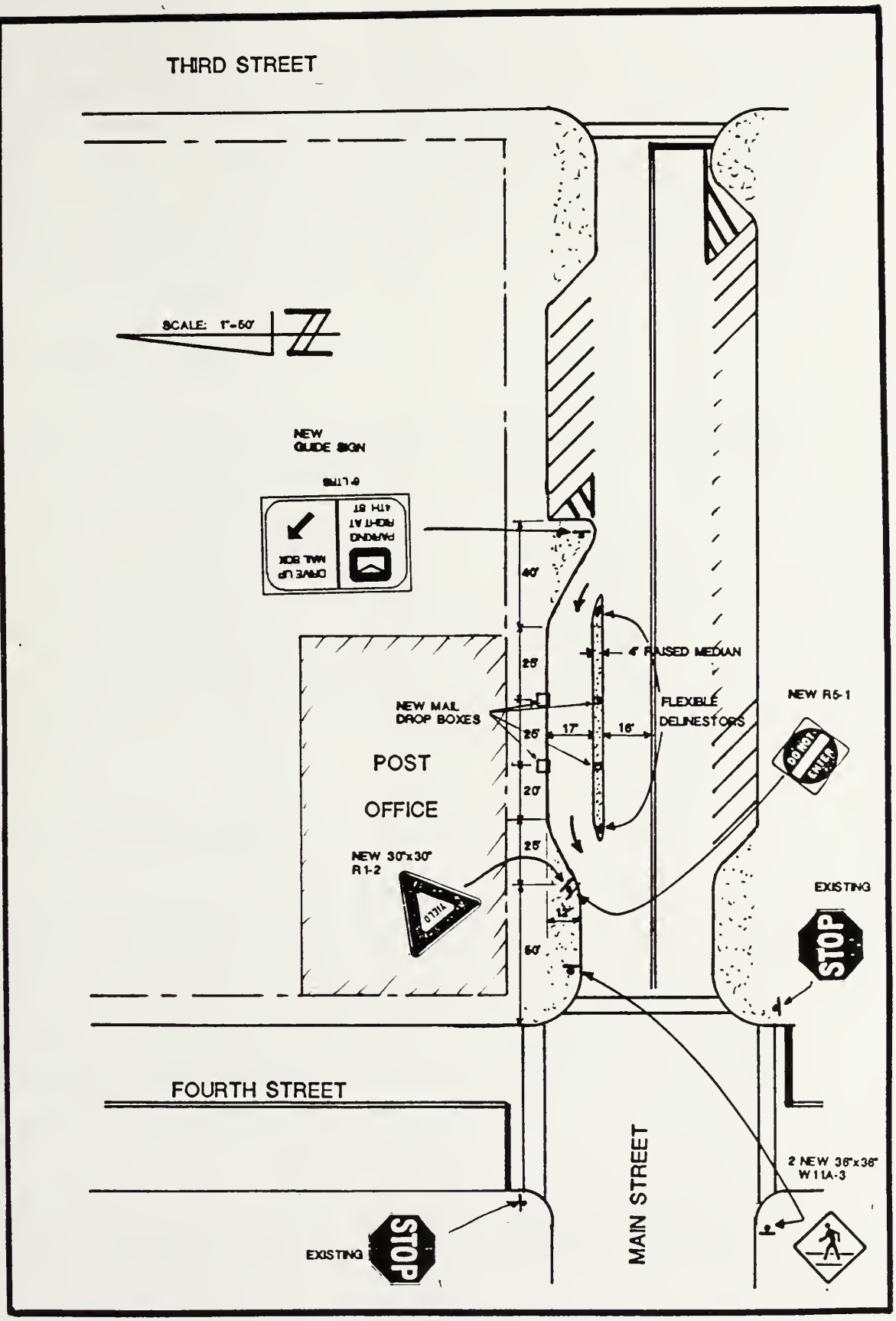


FIGURE NO.	TITLE:
VI-15	POST OFFICE CIRCULATION IMPROVEMENTS

If parking problems develop within the lane, no parking signs could be posted. People that require the service of a postal clerk, would have to park in the rear lot or on the other side of the street. Pedestrian crossing facilities should be improved to handle additional pedestrians. It may also be necessary for the post office to modify the rear entrance, to handle rear lot access. All of these improvement are contingent on the cooperation and assistance of the post office. Other alternatives may be available to solve these most serious problems.

10. SNOW REMOVAL SIGNS

Becoming more popular across the country, posting of snow removal streets to prohibit parking during storms, which require snow removal, is quite common. A typical sign is shown at right. Largely ignored, but considered necessary by many communities, it is posted periodically along major routes, which are vital to traffic flow in urban areas. If Hamilton should choose to adopt snow routes, it is recommended that they designate all collectors and arterial streets as emergency snow routes and select locations for sign installations.

11. SIGNAL WALK INDICATIONS

One of the most misunderstood signs or signals every perpetrated upon the American public, "Walk" and "Don't Walk" signals do not really mean what they say. If the signals indicated what they were designed to do, they would say "Leave The Curb" and "Don't Leave The Curb, But Those Walking Continue Walking". Obviously, the signs required for those messages would be quite large and would probably still be misunderstood. To complicate the matter, signal timing parameters allow you to set time intervals for each of these messages: Steady Walk

Flashing Don't Walk

Steady Don't Walk

The steady "Walk" indication must be a minimum of 4 seconds. The Flashing "Don't Walk" must be of sufficient duration for a pedestrian to cross the entire street at 3.5

seconds per foot. The steady "Don't Walk" comes on exactly when the yellow light is given to traffic proceeding in the same direction of pedestrian crossings. The problem occurs when pedestrians see the steady "Walk" indication, start to cross the street and the "Don't Walk" starts flashing after about four steps. They believe that they should be across the street when that happens. If that much time were allowed for the steady "Walk" light, too much time out of the signal's cycle would be taken away from vehicles waiting in the opposing direction. As an example, the existing crossing of Main Street would require 22 seconds for a steady "Walk" and 22 seconds for a flashing "Don't Walk", which when added to a 4 second yellow and 1 second all red, 49 seconds of the cycle (usually 60 seconds) would be used and no time would be left for the opposing approach.

In the case of Hamilton, the composition of pedestrians is skewed toward the higher age brackets and the calculation of walking speed should account for this. It is recommended that signal intervals be reset so that the pedestrian crossing time is calculated at 2.0 feet per second (low end of the range) and the resultant time difference be given to the steady "Walk" interval. It may be necessary to balance signal timing with vehicular efficiency in some cases. This problem will be easier to handle on Main Street, when the sidewalk project reduces the total crossing width.

D. SCHOOL AREAS

Local officials have always been concerned with school crossing protection and have had previous reviews of school zones by MDOH and the Department of Justice, in the past. This concern is evident, since Hamilton school zones are probably the best mark school areas of any community in the state. The following sections are a summary of findings and recommendations for school areas in Hamilton.

1. HAMILTON HIGH SCHOOL

The high school is located in the middle of Hamilton's old residential area, west of 5th, south of State Street, and north of Madison Street. The school was obviously built before automobiles were a common possession of high school students, because there are no provisions for off-street parking. The resultant problem is area streets saturated with parked vehicles, including corners and other places which inhibit the free movement of traffic. In addition, an annex building, across from the original high school, creates the need to cross Bedford during the day and therefore the street is temporarily block.

It is recommended that the City of Hamilton vacate Bedford Street between 5th and 6th and the high school can then install permanent gates with the necessary signing as shown in Figure VI-16. The street area can then be marked for parking and pedestrian movements. Parking along the street can be formally marked and parking restrictions at corners can then be rigidly enforced.

2. WASHINGTON ELEMENTARY

A Review of this school site indicated that every possible signing configuration, on all school access points, have been applied to the streets surrounding the school. All of the devices are in good condition and appropriately applied. The only problem noted was parking next to the cross walks. All curbs should be painted yellow, twenty feet in advance of the cross walks, and parking prohibitions in this area strictly enforced.

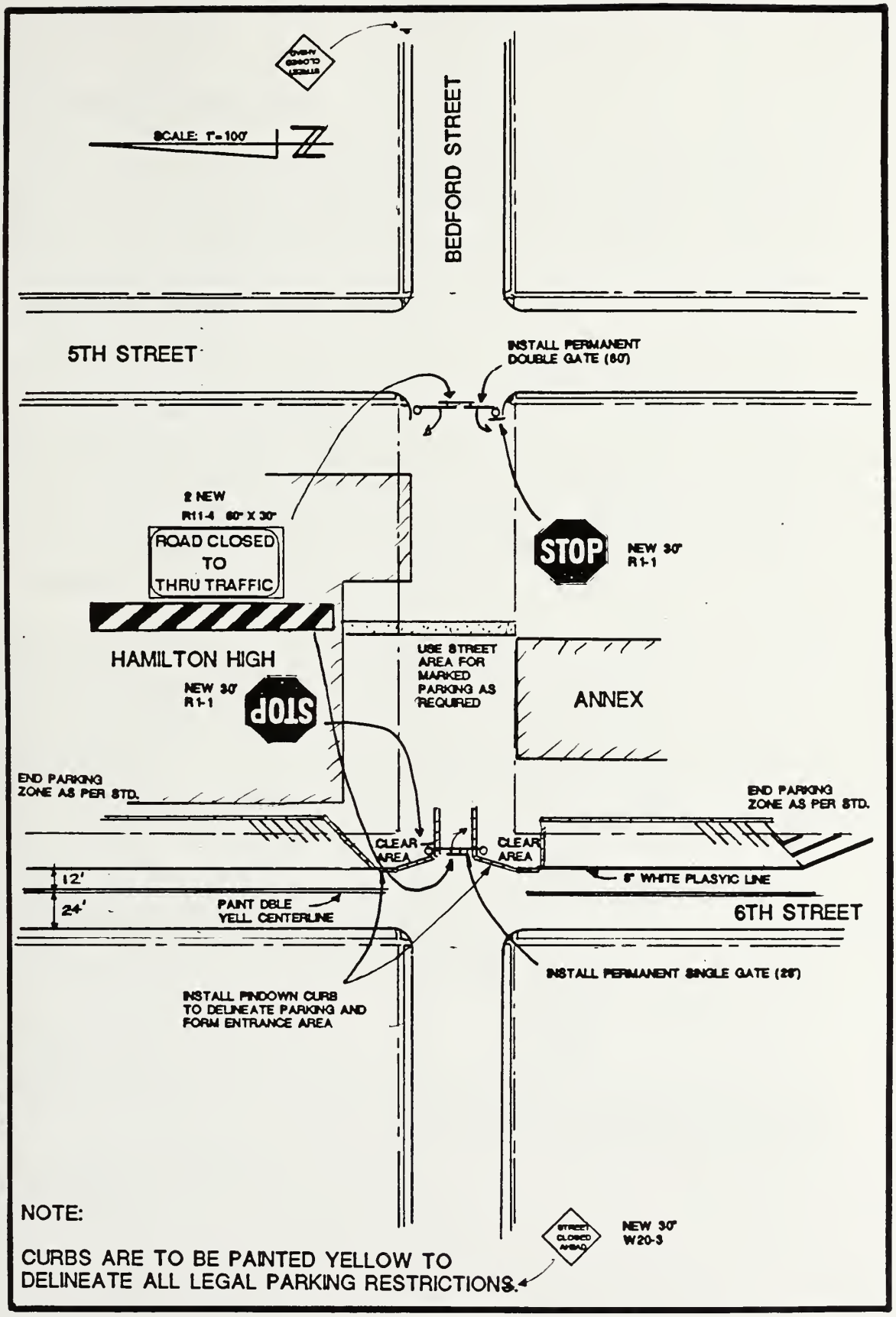


FIGURE NO.	TITLE:
VI-16	HAMILTON HIGH AREA IMPROVEMENTS

3. DALY ELEMENTARY SCHOOL

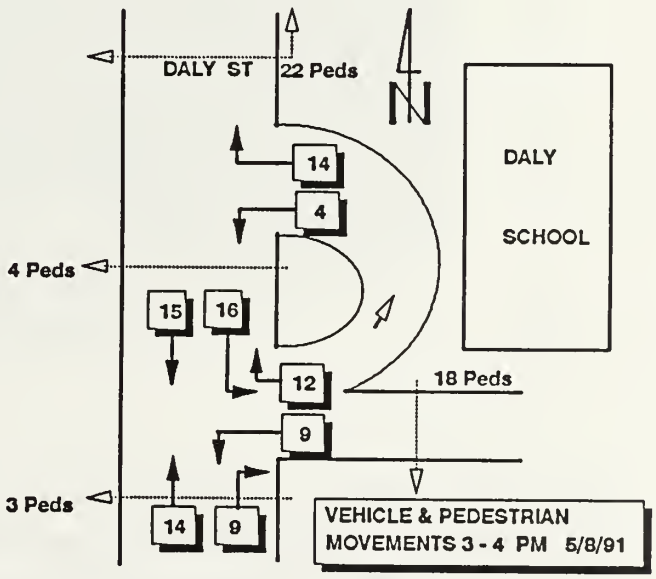
The newest elementary school in Hamilton, Daly Elementary is located along Daly Street in a pocket of City land surrounded by Ravalli County's jurisdiction. The school was constructed with sufficient setback from Daly Street to construct a loop road within the property, which serves as an area for loading busses and parents picking-up and dropping off children. A large parking area is also provided on the south side of the building. Unfortunately, the entrance to the loop road and the parking area are adjacent to each other, with no control of vehicle movements in an eighty foot wide approach. The parking area and the approach, both start at the north side of a fence and hedge, which leaves no sight distance onto Daly Street to the south. To make matters worse, children leave the school and have to cross the eighty foot approach, hidden from northbound Daly Street traffic. The school area is signed with school speed limit signs (20 mph); there are no marked crosswalks; and there are no sidewalks in the area.

A pedestrian and vehicle count was taken during an afternoon crossing period. The figure at right is a summary of that count.

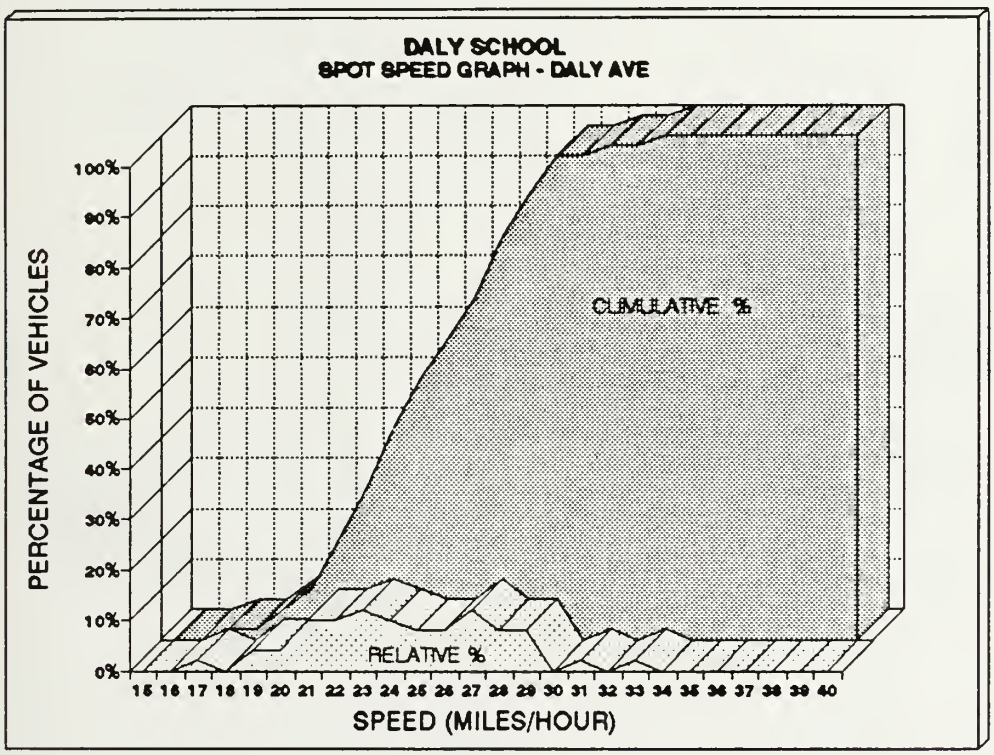
Of the seven children crossing Daly, 3 went straight across a field and the others went south.

The 22 children headed north stayed behind a fence on school property and dispersed.

Eighteen peds had to cross the wide, hidden approach.



A spot speed survey was taken during a crossing period and the graphic results of that study are shown in the figure below. The 85th percentile speed was determined to be 27.6 mph, with the pace speed being 19.5 to 29.5 mph. The 20 mph posted school speed does not seem to be unreasonable and no attempts should be made to change it, since new state law prescribes that school zones shall not be lower than 25 mph.



Based on operational observations of the school crossings and traffic movements, recommendations for improvements would focus on controlling the blind approach at the south end of the property and constructing on-site pedestrian facilities. Figure VI-17. illustrates all of the proposed improvements at this site. In addition to on-site improvements, parking at the building, opposite the south approach, creates an unnecessary hazard to children, when vehicles back out of the perpendicular parking spaces into the street and in the path of children.

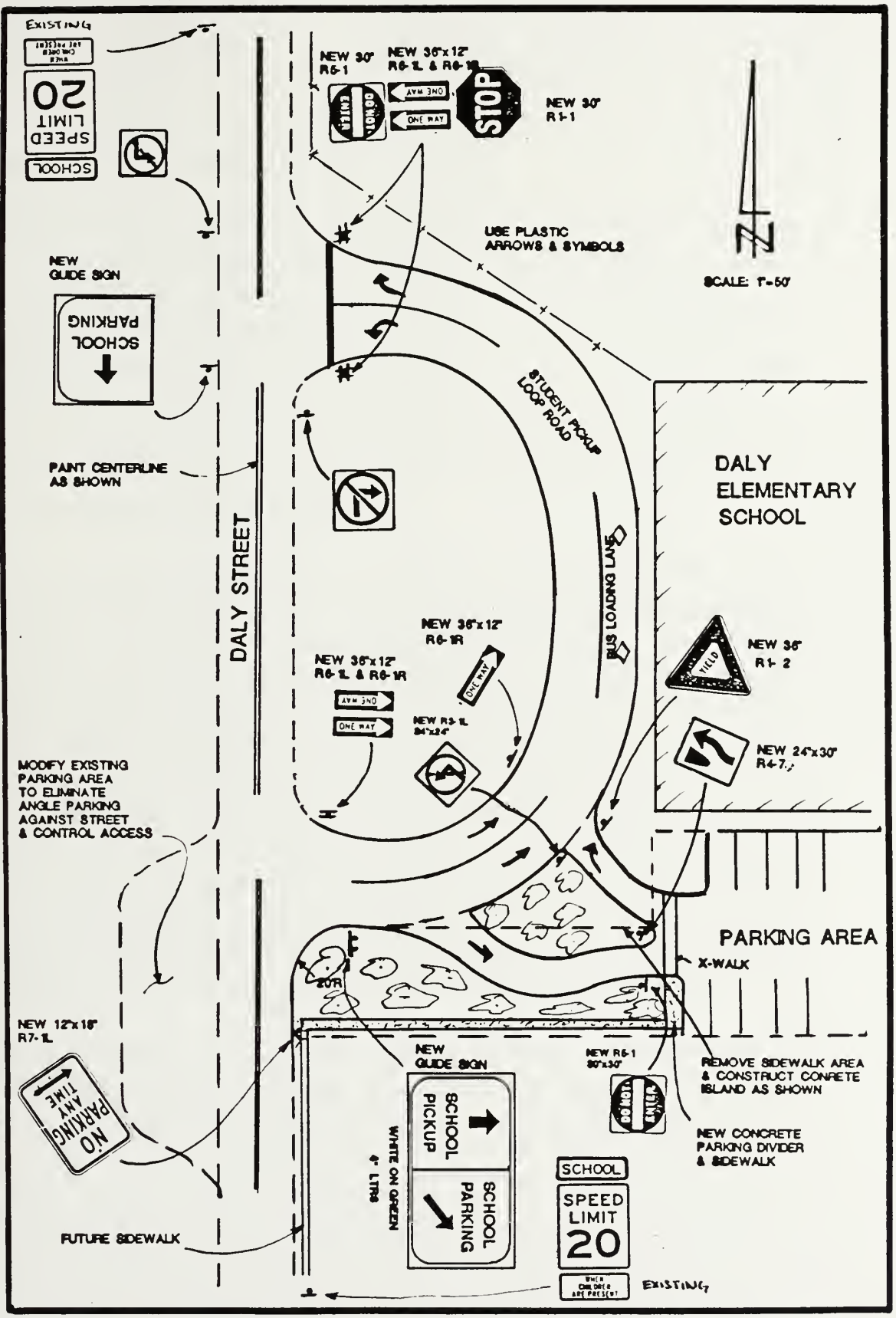


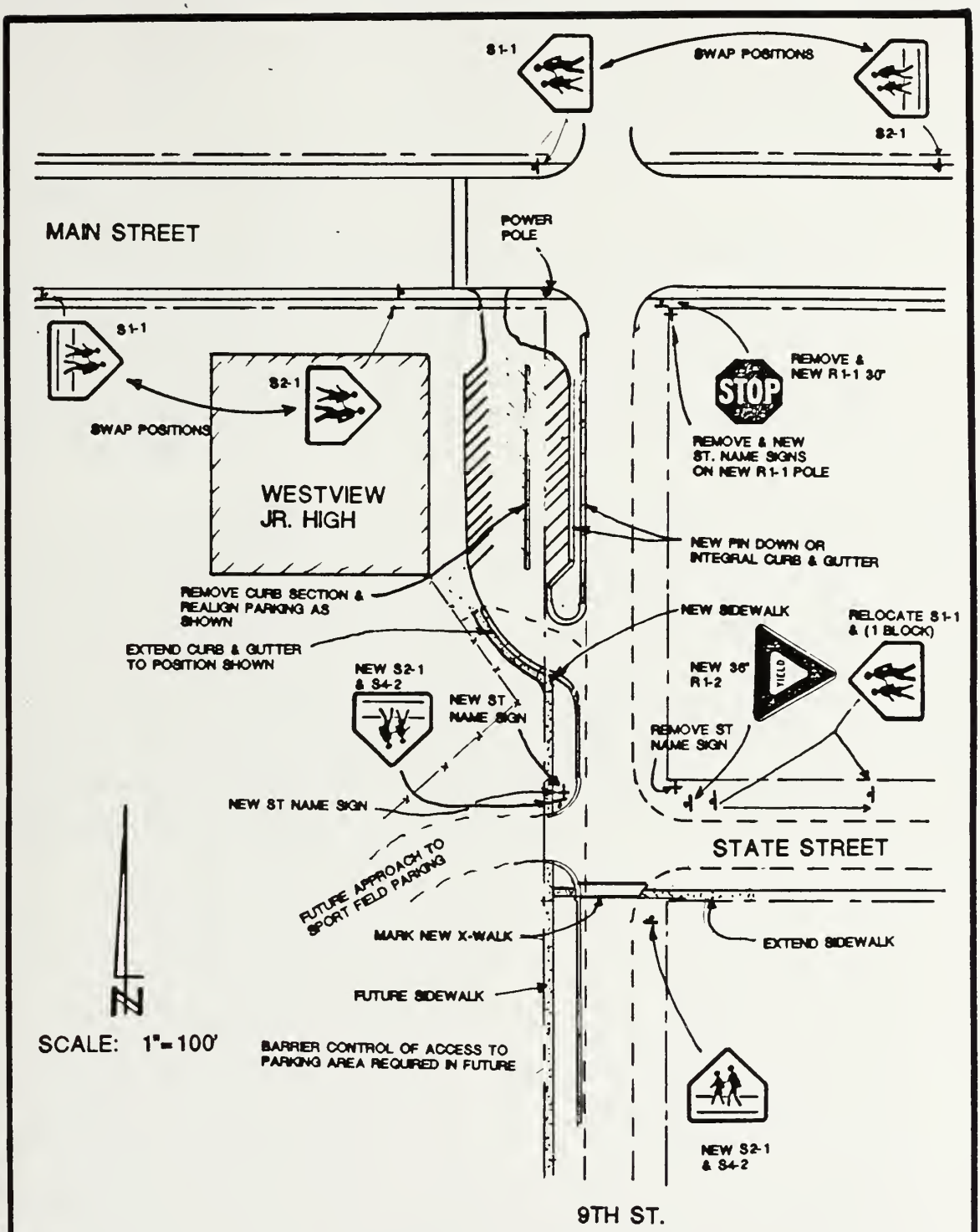
FIGURE NO.	TITLE:
VI-17	DALY SCHOOL AREA IMPROVEMENTS

4. WESTVIEW JUNIOR HIGH SCHOOL

The junior high school is located west of ninth street south of Main Street. This area was of concern to local officials because of the uncontrolled intersection at ninth and the fact that the sports field is located to the south of the school and access to it and the parking area is largely uncontrolled. The junior high is in the southwest corner of the Main Street intersection and has parking directly off of Ninth. There is a single line of angle parking abutting the street, in front of the school, and a double line of parking next to the school, on the other side of a divider. The line of parking abutting the street is angled, so that when a car backs out of a space, it ends up facing north, in the southbound lane of ninth street.

There is an advanced school area sign on the State Avenue approach and school crossing signs on Main Street, on either side of the crossing, directly across from the school. It is noted that the advanced school warning signs and the school crossing signs on Main Street have been installed in reverse order. Speed studies on both Ninth Street and Main Street were taken during crossing periods. Data on those studies can be found in the technical appendix of this report. It was determined that the 85th percentile speed on Ninth was 26.7 mph and 30.4 mph on Main Street. Neither of these streets would warrant a reduction in the speed limit. There was very little pedestrian activity noted. Five children headed west on State Street and eleven pedestrian, including six adults, crossed at the Main Street crossing. Seventeen high school girls crossed ninth, at State, and proceeded to the sports field, for track practise. The only particular problems noted in this school area were related to improper parking control at the school and the lack of access control along ninth street.

Figure VI-18. illustrates the improvements at this site necessary to avoid potential vehicle and pedestrian conflicts and to insure controlled traffic operations. Future improvements should consider curb, gutter and sidewalk within this entire area.



NOTE:

CURBS ARE TO BE PAINTED YELLOW TO DELINEATE ALL LEGAL PARKING RESTRICTIONS ESPECIALLY TWENTY FEET IN FRONT OF CROSSINGS.

FIGURE NO.	TITLE:
VI-18	WESTVIEW JUNIOR HIGH SCHOOL AREA IMPROVEMENTS

5. ASSEMBLY OF GOD SCHOOL

Data collection at the Assembly of God School, located at 6th and Main, was not directly obtained. In a conversation with Roger De Haan, Mrs. Hughes, school principal, indicated that they have 136 children in grades K through six. They typically have 10 to 15 children, which varies from year to year, who live on the other side of Main Street and who sometimes have to cross the street between 8:15 and 8:30 Am and after school at 3:15 PM.

There are not currently any marked or signed crossings on Main Street, at this location. It is recommended that the advanced school sign (S1-1) and the school crossing sign (S2-1) be installed at the appropriate locations, on either side of a new cross walk, to be painted on the west side of 6th Street crossing Main. All intersection and crosswalk parking restrictions should be marked prior to installing the new cross walk. The City should discuss their intention with the school officials and urge them to provide an adult crossing supervisor to monitor, teach and aid the children in the proper use of the crosswalk. None of the physical improvements should be completed until there is assurances that the crosswalk can be used safely.

VII. GENERAL RECOMMENDATIONS AND GUIDELINES

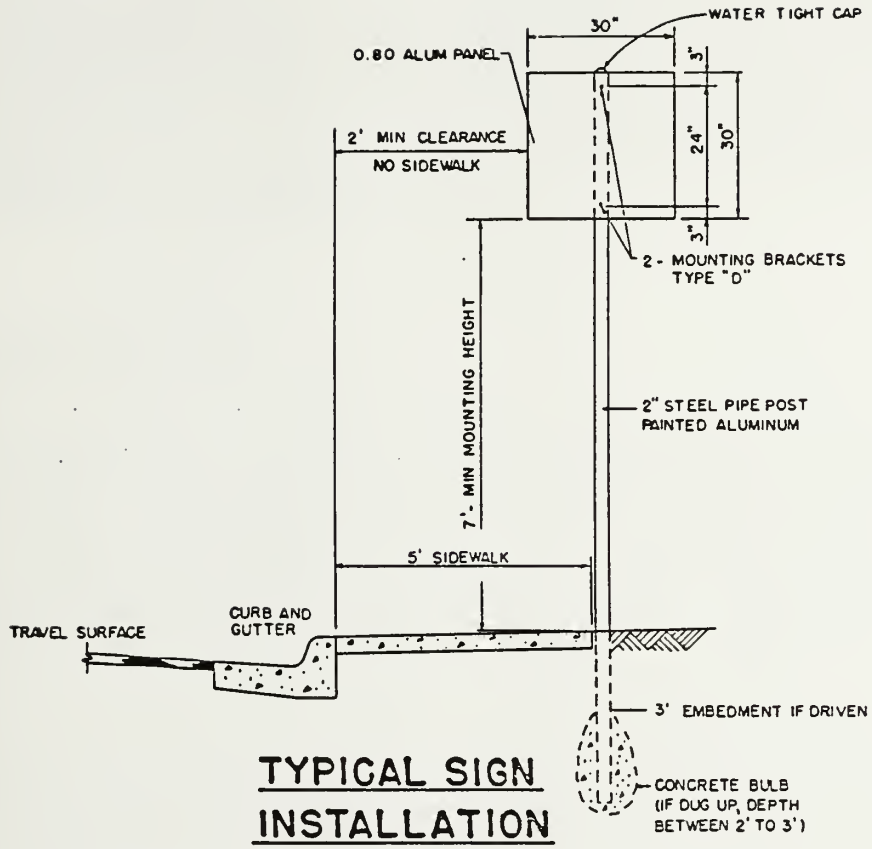
This section of the report is intended to be used as a guide by the City of Hamilton in an effort to improve traffic control and traffic operations within the city. Recommendations presented herein, concentrate on existing deficiencies discovered during the course of the study. The Manual of Uniform Traffic Control Devices (MUTCD) is the document which governs use of traffic devices, since it has been adopted as state law. It is recommended that the City of Hamilton also obtain copies of the Traffic Control Devise Handbook from the Superintendent of Documents, US Government Printing Office, Washington D.C., to aid their staff in application of signs, markings and signals.

A. SIGNING AND PAVEMENT MARKINGS

Traffic signs and markings within the City of Hamilton were found to have several deficiencies. Usage of proper traffic control devices seems to be adequate for the situations encountered. However, application of these devices is the cause of most concern because location and installation of traffic signs are inconsistent. Figure VII-1. provides guidelines for the typical installation of signs. The City of Hamilton should check each of existing sign installations and modify appropriately, to comply with these guidelines. In addition, the City should institute a program of periodic review of signs, to insure that they have not been damaged, misaligned or have become obscured by trees. The sign inventory map, contained in the technical appendix, will provide a basis from which to start a coordinated sign inspection program

1. STOP SIGNS

One of the most critical and common traffic devices in small communities, stop signs must be monitored periodically to insure effective usage. Approximately 50% of all stop signs in Hamilton were observed to have some degree of deficiency associated with them. Stop signs must be visible far in advance of the intended stop. The most common problem involving visibility, was linked to improper location or installation. The second most frequent problem was faded or damaged signs. Since signs loose reflectivity with time, all signs should be replaced after seven years, at least.



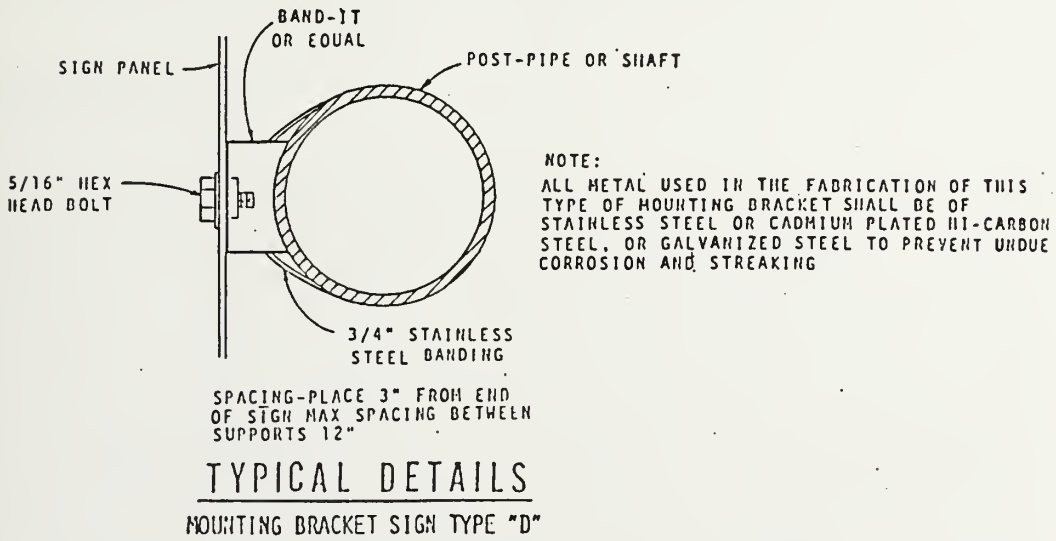


FIGURE VII-1. TYPICAL SIGN INSTALLATION STANDARDS

The most common stop sign size used in urban areas is 30"x30". In some circumstances, where accident problems have occurred or on wide streets and multi-lane facilities, it is advisable to replace these signs with 36"x36" or larger signs. When considering the aged driver population in Hamilton, it is recommended that all future stop sign replacements use a 36"x36" size, or larger.

2. STREET NAME SIGNS

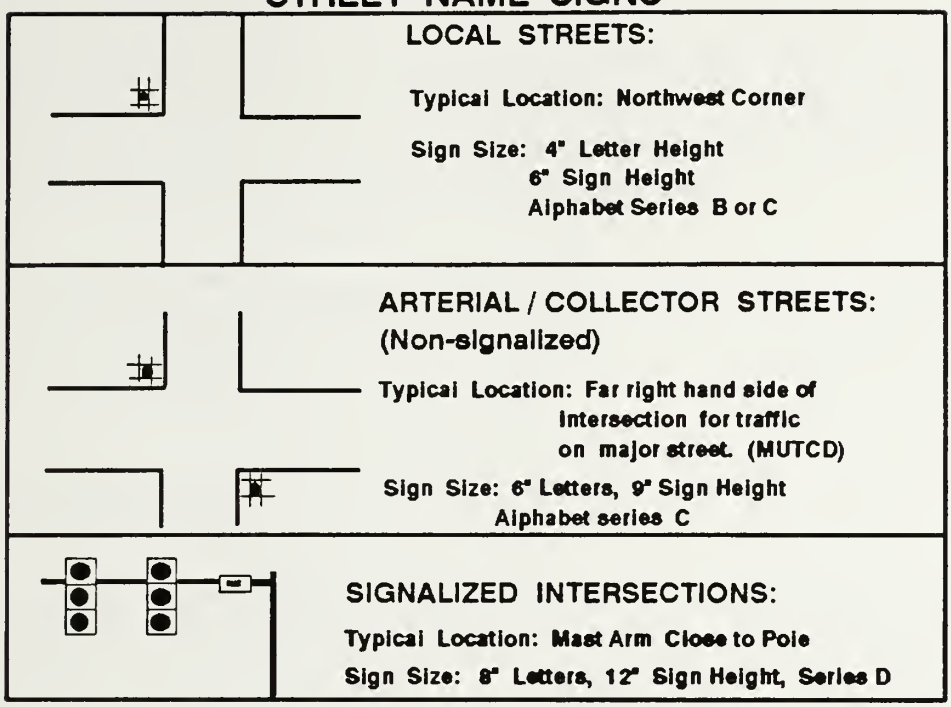
As previously mentioned, almost all of the street name signs in Hamilton are old style, enameled black on white. These signs are normally too small to be read from a distance and are virtually invisible at night. A small area of the City has newer white letters on green reflective sheeting, type signs. However, it appears that they do not completely conform to current standards, since the lettering is small and there is no white border. Also, the location of the signs is not always consistent.

It is recommended that the City of Hamilton develop a program to replace all of the existing street name signs with new standard signs. If the program is to be completed over a period of years, it would be advisable to begin on the arterials and collectors and then start on the local streets. Figure VII-2 provides guidelines for sign types and installation, that can be adopted as standards, within the City.

3. WARNING SIGNS

There are not a lot of applications for warning signs within the City of Hamilton. The only warning signs noted are "Dead End" signs and railroad crossing signs. No particular problems were noted with railroad crossing signs, but the "Dead End" signs have all been located improperly. In almost all cases, the signs have been installed 100 or more feet down the dead end street from the intersection, and are not always visible from the intersecting street. Value of the sign is only realized when it can be seen by drivers on approaching streets, in time to stop unnecessary entry onto those streets. If a vehicle has entered the street before the sign is visible, the most common reaction is to turn around at mid-block which increases potential for mishaps. In this case, having no sign at all would be better, since the back tracking maneuver would occur at the end of the street, with less conflicts. It is recommended that the

STREET NAME SIGNS



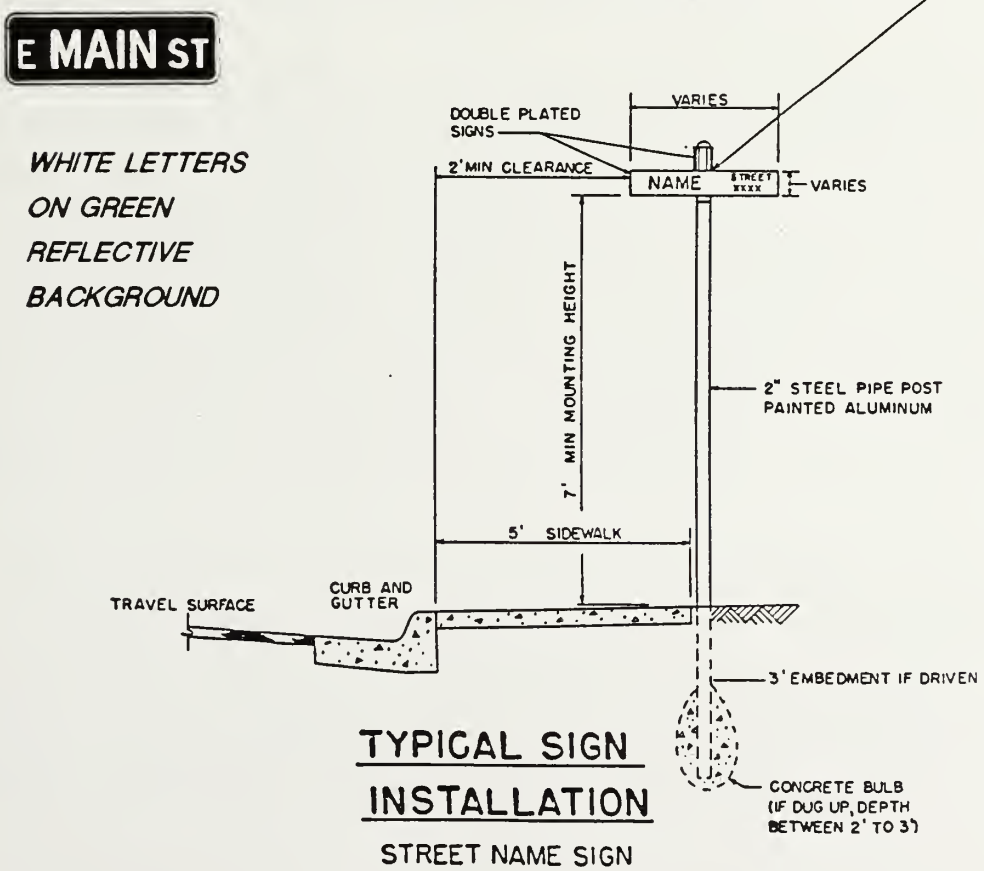


FIGURE VII-2. STREET NAME SIGN GUIDELINES

City relocate all of the "Dead End" signs to the intersection area. The standard location would be on the right hand side of the perpendicular intersecting street, and aligned so that it is visible from all street approaches. In no case, should it be located further than 40 feet from the edge of the intersecting street.

Any other application of warning signs, including school crossing signs, should met the letter and intent of the MUTCD. Overuse and misapplication of warning signs causes disrespect for their intended use.

4. REGULATORY SIGNS

The most common regulatory signs in Hamilton are parking control signs. Problems noted in regard to the use of these signs, involve location and alignment. Within one side of a block in the downtown area, as many as five different parking regulation signs may be found with no consistent pattern. Circulating traffic has little opportunity to discriminate between open parking spaces. When the parking control sign is not clearly visible from the traffic lane, it can cause needless parking maneuvers.

The use of special handicapped signs at certain locations should be examined carefully. With angle parking along the curb line every space is immediately adjacent to a business and it would be impossible to provide a handicapped space for every business. The primary reason for handicapped spaces is to provide extra width for loading and unloading of disabled persons. Proximity to facilities is a secondary factor. If certain businesses have a significant number of handicapped customers, a special special space may be warranted. Otherwise a standard location at the end of a block should be established for these spaces. When designated as a handicapped parking space, it should be readily accessible to a wheel chair ramp. This may mean reconstructing a portion of the sidewalk to accommodate the ramp.

Other parking control signs may be applied to specific spaces or locations or to an entire block. The exact placement and alignment of these signs is critical, to avoid confusion. Figure VII-3. illustrates the typical parking control signs found in MUTCD and provides a standard for installation of these signs. The R7-1 series of no parking signs are intended to marking the beginning and end of no parking zones with the use of arrows. The double headed arrow is an affirmation sign, usually placed at mid-block.

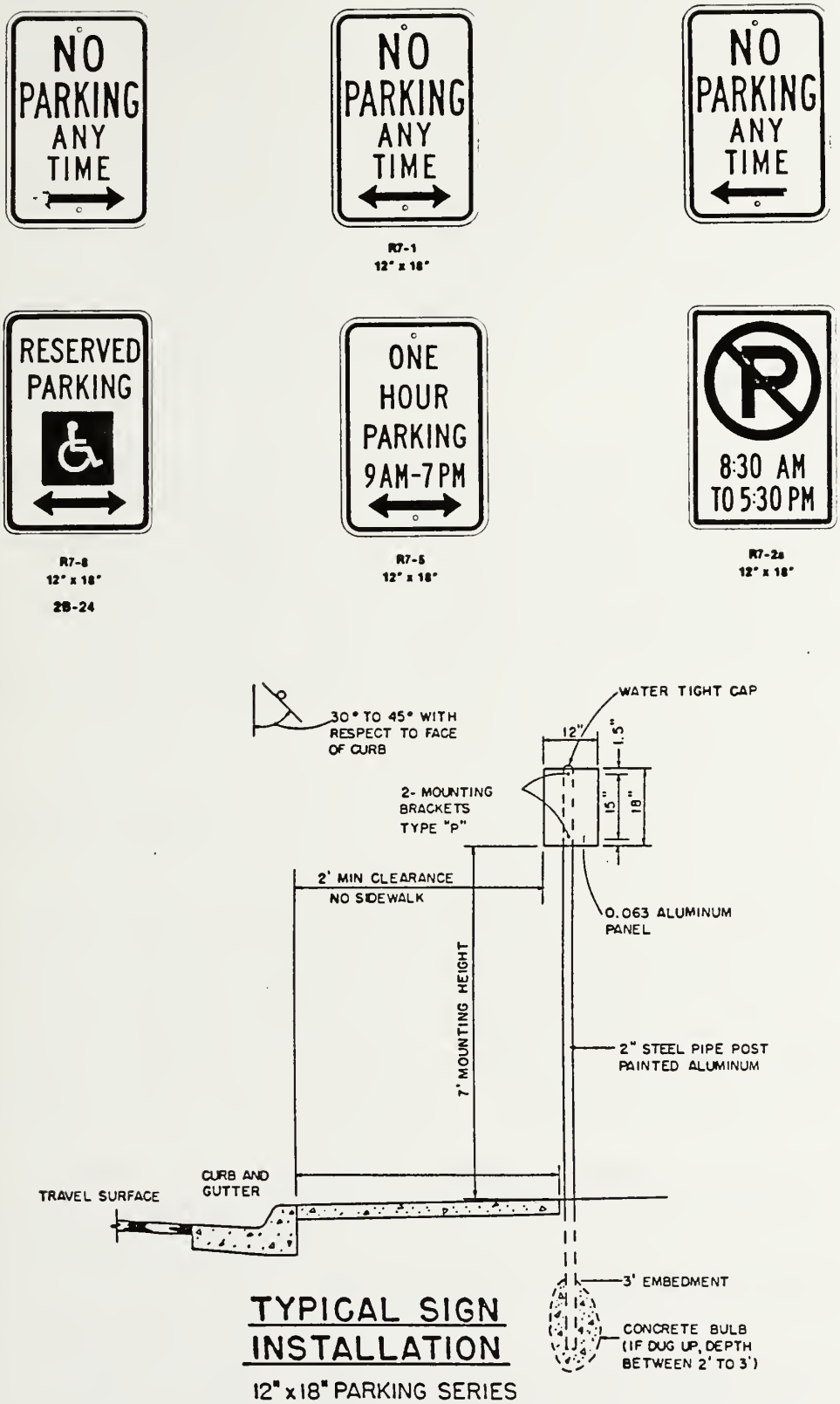


FIGURE VII-3. TYPICAL PARKING SIGN DETAILS

5. MARKINGS

Pavement markings provide a valuable guide to motorists using almost any type of street facility, but they are most critical in urban areas with lane control designations. There was a notable lack of pavement markings within Hamilton. Some remnants of paint and plastic striping were found, which indicates that the markings wear out too fast or there is a difficulty involved in replacing them. US 93, especially at the intersection areas, is in desperate need of restriping. The downtown area is also a prime candidate for new pavement markings.

In most of the site specific recommendations, plastic pavement markings were specified. This recommendation should be applied to all location in Hamilton which have an ADT in excess of 4,000 vehicles and on all streets which have more than one traffic lane in each direction. Plastic pavement markings, if properly applied, will maintain high visibility for a number of years. When using paint, the stripes may last over a year in some areas, but the effective visibility deteriorates rapidly and may become ineffective within weeks of its application.

B. TRAFFIC SIGNALS

Existing traffic signal installations in Hamilton suffer from a number of deficiencies. The old span wire signal at Main and Second Street is completely outdated and does not meet any of the current standards. The three signal installations along US 93 which were constructed by MDOH, meets minimum standards set forth by MUTCD. However, these signals are bare bones installations which will require upgrading as traffic volumes change. Some of the immediate needs at these existing locations are:

1. Pedestrian push buttons must be readily accessible to pedestrians. This would mean constructing additional sidewalk or installing a separate pedestal for push buttons.
2. Lane control signs should be mounted on the mast arms when an exclusive turn lane is present.
3. Larger street name signs should be prominently mounted on the mast arms.
4. The signals should be equipped with emergency vehicle detector

systems, to provide preemption of normal signal cycles during fire engine emergencies.

5. Pedestrian signal heads could be replaced with symbol figures rather than "Walk" and "Don't Walk" indications, to help avoid confusion.

6. None of the wiring or conduit runs have pull boxes. Future signal installations should have pull boxes near each pole and each set of loop detectors to facilitate relocations and repair.

7. Periodic review of signal timing should be completed to ensure the efficient operation of the signals. Reaction time of the aged driver should be considered, especially in setting the yellow clearance interval.

8. Pedestrian signal timing should be modified, wherever possible, to allow more time in the walk interval.

Installation of new traffic signals at locations recommended in other sections of this report should be designed with these needs in mind. New signals on Main Street will require a coordination system that can either be hard wired or on a time based system. It is recommended that they be interconnected by a hard wire installation if at all possible. Immediate planning is required for these signals, since the downtown sidewalk project will be under construction in the near future. Ideally, pole bases, conduits, pull boxes and a controller pedestal should be installed at the same time as the new sidewalks to avoid reconstructing large portions of the sidewalk, at a later date. Since the Department of Highways requires significant time to program these types of improvements, it would be desirable for the City to retain a traffic engineering to design the signals and inspect installation of the signal components which are needed immediately.

C. PARKING

Identified as the most troublesome problem in Hamilton, parking must be tightly controlled to eliminate accidents and improve traffic operations within the City. Parking regulations must be established according to state law and local ordinance and enforced diligently.

Angle parking throughout areas of the City should be eliminated wherever possible and new developments should not be allowed to proceed, if the planned construction depends on angle parking within the public street.

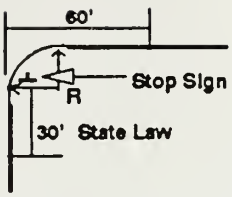
Parking restrictions on Main Street are somewhat different than other areas of town, because of the street geometry and proposed sidewalk project. Proper restrictions on Main Street are defined in the site specific section of this report. Parking at other locations are illustrated in Figure VII-4., on the following page. According to state law it is illegal to park within 30 feet of the safety zone (intersection radii) or within 30 feet of a stop sign. With angle parking, the restriction should be 60 feet beyond the edge of the intersecting pavement as shown in Figure VII-4. At intersections with parallel parking, the 30' restriction would apply. Parking restrictions near alleys require a 20' zone on either side of the alley lines. State law requires no parking within 20' of a crosswalk and within 50' of a railroad crossing. If angle parking exists near a crosswalk, consideration should be given to increasing the restricted area to a minimum of 30 feet.

All of the above parking restrictions should be marked with yellow curb paint or no parking signs, whenever possible. It may be impractical to sign every intersection that does not have curb and gutter. Therefore, drivers knowledge of the law will have to be relied upon, unless accident experience indicates that signing would be warranted.

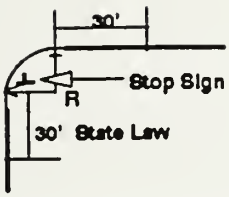
Because of the apparent lack of knowledge regarding parking restrictions in Hamilton, it is recommended that the restrictions be published in the local paper and other media along with the Cities' intent to ticket illegally and improperly parked vehicles. This notice should be repeated several times over a period of weeks, prior to beginning an intensive enforcement effort. Periodic repetitions of this procedure should educate the majority of people in Hamilton and provide a safer traffic environment, within the City.

D. PEDESTRIANS

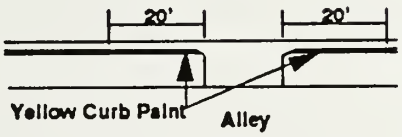
Both children and adults practice hazardous pedestrian movements in Hamilton. Jay walking on Main Street is common and is probably related to the wide streets and lack of positive control at the intersections. The new sidewalk project in the downtown area should alleviate this problem, to some degree. Walking within the street section, in areas provided with sidewalk, is somewhat puzzling. However, it is thought to be related to the wide street sections combined with the gravel areas between the paved street and the curb. The only streets that this problem was not noted was on 4th Street, where the pavement extends from curb to curb; good drainage is provided;



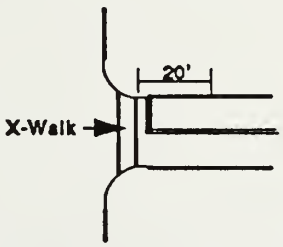
INTERSECTION WITH ANGLE PARKING



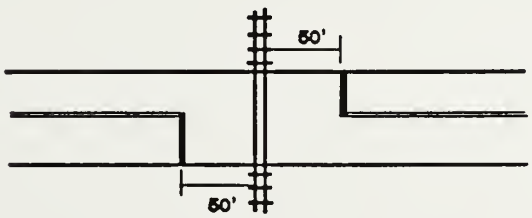
INTERSECTION WITH PARALLEL PARKING



PARKING AT ALLEY



PARKING NEAR CROSSWALK



PARKING NEAR RXR

FIGURE VII-4. PARKING RESTRICTION LOCATIONS

and parallel parking is used. Future street reconstruction in Hamilton should provide for full width paving between curb sections. In addition, the street width should be no wider than required for traffic operations. A typical street section would be no wider than 48' from back-of-curb to back-of-curb. This would allow for two traffic lanes and two parking lanes, which would be uninviting for pedestrian traffic.

E. INTERSECTION SIGHT DISTANCE

For the most part, Hamilton's intersections are free of permanent sight restrictions. The City should check and clear whatever obstructions that do exist, such as trees, shrubs and fences and then periodically check all intersection corners to ensure that they remain clear.

If an ordinance does not already exist, one should be created which mandates an intersection clear zone. The ordinance should establish a sight triangle where no object exceeding 30 inches in height can be placed. A sample ordinance can be obtain from any of Montana's larger Cities.

F. THE AGED DRIVER

The first generation to grow up with the automobile is now plagued with by existence. The aged driver, commonly defined as those who are older than 60 years, has a distinct problem functioning in the increasingly complex street systems of today. A report published in the May 1991 issue of the Journal of Transportation Engineering, Vol.117 No. 3, "Older Drivers and intersection Traffic Control Devices", indicates that the aged driver experiences a much greater involvement in accidents than the average population. The report also indicated that the most significant problems are related to turning movements and operations on multi-lane facilities. As America ages, traffic volumes increase and the new facilities built, to accommodate the increased traffic, become more complex. Recognition of these disturbing facts is becoming a national concern for transportation engineers and planners. Various strategies and devices to accommodate the aged driver are being proposed and tested. No clear answer to this problem is now is sight. Recommendations within this section are merely another step in the process of attempting to alleviate the problems faced by the aged driver.

1. TRAFFIC DEVICES

Much can be done to reduce the aged drivers difficulty in seeing appropriate traffic control devices. Larger, more intense signs and pavement markings are logically the best way to accomplish increased visibility. Proper location and alignment of signs combined with an emphasis in positive guidance and advanced information will reduce perception time and allow for more decision time.

The Journal of Transportation report, previously mentioned, indicates that inability to judge the proper maneuvers at multi-lane intersections and at signalized intersections with multiple phases Is the primary factor in the aged drivers accident and violation rate. The article also indicates that the size and visibility of traffic devices is not significant. However, specific conditions of the tests were not mentioned and little supporting evidence was given for this conclusion. However, the information that was provided would indicate that design of simpler intersections requiring minimum application of traffic control devices, would be superior to those with more complex lane geometry requiring more sophisticated traffic control devices. Some of the site specific recommendations within this report, attempt to reduce the complexity of streets and intersections by providing minimum usage of traffic control devices. Devices recommended within this report attempt to address critical vehicle maneuvers through intersections. Lack of these devices would be a more serious problem than the degree of traffic system complexity.

2. SAFETY PROGRAMS

Various factions within the transportation field advocate rigid licensing procedures and revocation of licenses for aged drivers not meeting set standards. When one looks at the big picture, this philosophy is neither pleasant nor practical. By the year 2000 approximately 27% of Americans will be over 60 years old. The American economy and society in general has evolved around use of the automobile. With the advent of the modern auto, Americans began populating suburbs because of the mobility offered by the automobile. Later, shopping centers, within driving distance of the suburbs, replaced the corner grocery store and work centers became scattered about the countryside. Today, almost every aspect of life involves use of the automobile. Elderly people depend upon the auto for survival and independence as much as any other

segment of society. If we would restrict their right to drive, we would also have to provide an alternate life line, which could be an economic burden to all of society. Rather than engage an action which would have far reaching consequences on the economy, the solution must be found in a program which improves both our transportation system and the skills of the aged driver.

It is recommended that Hamilton develop a program which would provide driver education opportunities for the aged driver. Most current programs focus on skills necessary to become licensed, which usually address rules of the road. An aged driver program would be more productive, if the focus were similar to the defensive driving program that was popular years ago. This emphasis could be accompanied by education on the more complex aspects of traffic control devices such as the meaning and use of left turn lanes, lane use signs, signal indications, pedestrian indications, stop bars, crosswalks, and advanced signing. Misconceptions regarding proper response to driving situations and traffic control devices is widespread among the general population. This lack of knowledge is undoubtedly more prominent among aged drivers. Development of an educational program could take many and varied forms. It is suggested that the City attempt to organize a specific pilot program, in cooperation with the Department of Justice. The City may also want to solicit help from local or state groups associated with the elderly. The program should emphasize education of the aged before accidents occur, rather than after. It shouldn't be exclusively for drivers involved in accidents or driving violations, as part of a mandatory requirement. The program should be designed to attract community participation, as a benefit to the elderly.

G. FUTURE SYSTEM IMPROVEMENTS

Documented traffic growth within the City of Hamilton has been significant in the past ten years, especially when the decline in other areas of Montana is considered. This growth has been reflected in the increasing traffic operation problems on US 93. Two signals were installed in 1990 and it appears that several more signals could be added in the near future. At the present rate of growth, traffic volumes on some sections of US 93 could exceed 27,000 ADT within the next ten years. While this volume of traffic could be handled by adding a continuous turn lane and other traffic improvements, the added capacity would have little effect on accident potential, especially for the aged driver.

The existing system of streets is almost exclusively dependant upon US 93 and all area growth will be reflected in traffic volumes on that street. In order to change this situation, alternative street system routes must be identified and planned before the community is strangled by its own growth. It is recommended that the City of hamilton and Ravalli County consider development of a comprehensive transportation plan for the Hamilton urban area. In addition to identifying planned system improvements, a comprehensive plan would aid in zoning and controlling growth within the urban area. The Montana Department of Highways should be notified of your desires to develop a transportation plan. They may be able to provide the technical and financial assistance to develop the plan.

H. ACCESS AND DEVELOPMENT IMPACTS

The preponderance of accidents and congestion at some of Hamilton's newer business establishments can be traced to inadequate location of site accesses; inadequate parking; high traffic demand on substandard facilities; and poor site circulation. Traffic accessibility studies are a method some of Montana's larger urban areas are using to avoid these situations. Local ordinances tied to building codes, zoning and subdivision review, specify the need for a traffic study when traffic demand to a proposed development is expected to exceed a certain fixed volume, ie. 500 trips per day. Also certain special uses, such as drive thru windows, also require a study due to the potential problems that site operations may inflict on the street system.

The traffic study is usually completed by a consultant retained by the developer and whose qualifications to perform the study are approved by the City. The results of the study usually identify any problems or impacts that the development may have on the street system for which the developer is required to mitigate, by either modifying the site plan or contributing to required street and traffic improvements. With such an arrangement, the developer receives the benefit of improved access, parking, and circulation and the City is assured of minimum impact to the public street system. It is therefore recommended that Hamilton consider adoption of an ordinance that would require traffic accessibility studies for developments meeting fixed criteria.

VIII. PROJECT PLANNING

This section of the report is intended to be used as a guide by the City of Hamilton in an effort to schedule project improvements which are recommended within this report. There are twenty projects identified in total. Only eleven of those can be totally attributed to traffic safety and therefor, only those projects have been ranked according to priority. These eleven projects should be submitted to the Montana Department of Highways for consideration in their safety program. Other possible funding sources are identified in the following sections.

A. PROJECT COST ESTIMATES

Preliminary cost estimates were prepared for each of the twenty projects identified within this study and can be found in the technical appendix, separate from this report. The estimates were based on fixed unit costs developed by the Department of Highways for the purpose of funding off-system safety projects, These costs are limited to signing and guardrail. All other costs were based on a tabulation of the most recent bids taken by the Department of Highways.

A summary of cost estimates is listed in Table VIII-1., on the following page. These costs should be considered preliminary and do not include engineering or administrative costs, which will be associated with some of the more complex projects. Generally, any of these projects which have an estimate less than $ 10,000 could be implemented by the city without developing formal plans and specifications. In this case, the actual cost of implementation should be much less than noted.

The first eleven projects could be submitted to MDOH for off-system funding consideration. These projects will likely be programed by MDOH through various funding sources. Primary funds could be used on US 93. Secondary funds could be used on Main Street, while the Marcus & Main Street intersection is currently in the process of being programmed by MDOH. In addition, the entire report should be submitted to the state, since there are recommendations and information that merits consideration by MDOH.

Some of these projects must be funded partially or in total by other parties, such as the US Post Office, the School District, and the Citizens Bank.

TABLE VIII-1. SUMMARY OF PROJECT COST ESTIMATES

NO.	SITE LOCATION	TYPE OF IMPROVEMENTS	CAPITOL COST IMPROVE
1	SEVENTH & RIVER	SIGNING & MAINTENACE	$650
2	THIRD & MADISON	SIGNING, MAINTENANCE & CURB PAINT	$930
3	SEVENTH & MADISON	SIGNING	$700
4	FIFTH & MADISON	SIGNING & CURB PAINT	$640
5	US 93- RIVERSIDE CUTOFF	RECONSTRUCTION, SIGNING & MARKING	$17,800
6	MAIN STREET CORRIDOR	SIGNING, MARKINGS & SIGNALS	$184,640
7	STATE STREET CORRIDOR	SIGNING, MARKING, PARKING & MAINT.	$22,530
8	THIRD STREET CORRIDOR	SIGNING, MARKING & MAINTENANCE	$3,270
9	SECOND STREET CORRIDOR	SIGNING, MARKING & MAINTENANCE	$24,540
10	FIRST ST (US 93) CORRIDOR	SIGNING, CURBS, SIGNAL MODIFICATIONS	$30,280
11	PINCKNEY CORRIDOR	SIGNING & MARKINGS	$8,760
12	CITIZENS BANK	CURB, LANDSCAPE, SIGNING & SIDEWALK	$13,040
13	POST OFFICE PARKING	CURB ISLAND, SIGNING & MARKING	$8,420
14	HAMILTON HIGH	SIGNING, MARKING & GATES	$6,520
15	DALY ELEMENTARY	PAVING, ISLANDS, SIGNING & MARKING	$22,100
16	WESTVIEW JUNIOR HIGH	CURB, SIDEWALK, SIGNING & MARKING	$11,720
17	ASSEMBLY OF GOD SCHOOL	SIGNING & MARKING	$1,360
18	REPLACE STREET NAME SIGNS	LONG TERM SIGNING	$36,000
19	REPLACE OLD STOP SIGNS	REPLACE SIGNING	$5,600
20	PAINT CURB YELLOW	MARKINGS	$9,600
		TOTAL ALL PROJECTS =	$389,100

B. ESTIMATED BENEFITS

Benefits to be derived from the recommended project improvements cannot always be quantified, since many of the improvements would be designed to improve efficiency and to mitigate existing and future problems. Dollar benefits realized from efficiency improvements can be quantified, if detailed analysis were performed, but the results are not always reliable because of the widely variable time value equivalent of money. Therefore, only safety improvements were quantified.

Eleven of the twenty projects related to safety improvements were analyzed and accident reduction percentages were applied to the recommended improvements. Percentage accident reduction was based on published data and past experience, relative to the type of accident and the known results achieved by implementing specific improvements. Calculations of accident reduction parameters for use in the benefit/cost ratio can be found in the technical appendix.

C. BENEFIT/COST RATIOS

Table VIII-2, on the following page, illustrates the computation of benefit/cost ratios according to the MDOH published methods. As can be seen in this table, all of the project sites would have a ratio above one, which indicates a positive return on the investment. The average ratio is 17.0, which indicates a 17 fold return on the investment. Some of these projects would provide an incredible savings in terms of the areas economy. As an example, relatively simple improvements at the intersection of Fifth and Madison Streets would save the public approximately $ 11,000 per year for an initial investment of $ 640.

TABLE VIII-2. SITE RANKING BY BENEFIT/COST RATIOS — CALCULATION SUMMARY

RNK #	SITE LOCATION	PR LIFE	COSTS: CAPITOL COST IMPROVE	COSTS: EQUIV ANNUAL COST	COSTS: ANNUAL MAINT. COST CH	COSTS: TOTAL ANNUAL COST	BENEFITS: Q	Afi	Apd	PPI	Ppd	BENEFITS: ANNUAL BENEFIT	B/C RATIO
1	FIFTH & MADISON	5	$640	$169	$20	$189	$37,164	0.50	0.25	60%	60%	$11,602	61.44
2	SEVENTH & MADISON	5	$700	$185	$20	$205	$37,164	0.25	0.75	60%	60%	$6,375	31.15
3	THIRD & MADISON	5	$930	$245	$20	$265	$37,164	0.75	1.00	20%	30%	$6,145	23.16
4	THIRD STREET CORRIDOR	5	$3,270	$863	$50	$913	$37,164	1.50	1.75	33%	40%	$19,835	21.73
5	US 93- RIVERSIDE CUTOFF	20	$17,800	$2,091	$50	$2,141	$40,107	1.25	1.50	60%	20%	$31,141	14.55
6	SEVENTH & RIVER	5	$650	$171	$20	$191	$37,164	0.25	1.00	20%	30%	$2,354	12.30
7	FIRST ST (US 93) CORRIDOR	5	$30,280	$7,988	$400	$8,388	$40,107	9.00	21.0	22%	15%	$85,820	10.23
8	STATE STREET CORRIDOR	7	$22,530	$4,628	$100	$4,728	$37,164	1.00	7.00	63%	50%	$29,236	6.18
9	SECOND STREET CORRIDOR	5	$24,540	$6,474	$150	$6,624	$37,164	2.00	10.3	40%	51%	$38,324	5.79
10	PINCKNEY CORRIDOR	5	$8,760	$2,311	$50	$2,361	$37,164	0.25	4.25	10%	29%	$2,833	1.20
11	MAIN STREET CORRIDOR	10	$164,640	$26,794	$200	$26,994	$37,164	1.00	8.00	60%	60%	$30,088	1.11
	TOTALS :		$274,740	$51,918	$1,080	$52,998						$263,763	
	AVERAGES :	7	$24,976	$4,720	$98	$4,818						$23,978	$17

COMPOUNDED INTEREST RATE :	10%
COST OF FATAL ACCIDENT :	$500,000
COST OF INJURY ACCIDENT :	$11,000
COST OF PROPERTY DAMAGE ACCIDENT ;	$1,500
I/F RATIO SECONDARY :	17.69
ADTa/ADTb :	1.02
VALUES FROM MDOH SAFETY SECTION	

D. PROJECT PRIORITIES

The computation of benefit/cost ratios provides a ranking which many would consider to be a priority ranking. However, it should be noted that the highest B/C ratios almost always favor the low cost projects. To avoid basing project priorities on mere economics, it would be more altruistic to consider accident experience as well. Therefore, the composite factors which combined number of accidents; accident rate; and accident severity (presented earlier in this report) were used in combination with the B/C ratios to obtain a priority factor. Table VIII-3. presents the results of this analysis. The composite accident rate was adjusted for corridor by dividing the composite rate by the number of intersections within each corridor. The accident factor and the B/C ratio are then weighted 67% and 33% respectively, to obtain a total weighted priority rate. Table VIII-3. lists the eleven project sites by order of descending priority factors. A brief examination of this list reveals that it provides a better representation of the most pressing needs in Hamilton than the B/C ratio listing would have.

TABLE VIII-3. PROJECT SITE RANKING

RANK NO.	SITE LOCATION	ACCIDENTS RATE	ACCIDENTS WEIGHTED	BENEFIT/COST RATIO	BENEFIT/COST WEIGHTED	TOTAL WGHT RATE
1	MAIN STREET CORRIDOR	147.50	98.83	1.11	0.37	99.19
2	THIRD STREET CORRIDOR	83.82	56.16	21.73	7.17	63.33
3	STATE STREET CORRIDOR	69.46	46.54	6.18	2.04	48.58
4	PINCKNEY CORRIDOR	45.50	30.49	1.20	0.40	30.88
5	FIFTH & MADISON	3.21	2.15	61.44	20.28	22.43
6	SECOND STREET CORRIDOR	23.11	15.48	5.79	1.91	17.39
7	SEVENTH & MADISON	3.81	2.55	31.15	10.28	12.83
8	THIRD & MADISON	5.99	4.01	23.16	7.64	11.66
9	FIRST ST (US 93) CORRIDOR	10.00	6.70	10.23	3.38	10.08
10	SEVENTH & RIVER	6.42	4.30	12.30	4.06	8.36
11	US 93- RIVERSIDE CUTOFF	3.55	2.38	14.55	4.80	7.18

E. SCHEDULING AND FUNDING

The City of Hamilton has indicated that they will be obligating the majority of their annual street paving funds toward implementing these improvements in 1992. Projects for which this funding source should be committed are those which have a high priority and which have little chance of qualifying for other funding sources, such as MDOH programs and private development improvements. The candidate locations for this source would be:

Main Street Corridor:
Signing, Pavement Markings, Preliminary signal work - Signals may qualify for MDOH Secondary Funds

Third Street Corridor:
Signing, Pavement Markings

State Street Corridor:
Signing, Pavement Markings

Pinckney Corridor:
Signing, Pavement Markings, Should be Completed in Conjunction with Citizens Bank Lot Improvements

Fifth & Madison:
Signing, Markings

Second Street Corridor:
Signing, Pavement Markings

Seventh & Madison:
Signing

Third & Madison:
Signing, Markings

Seventh & River:
Signing, Maintenance

Assemble of God School:
Crosswalk Installation

Street System:
Replace Street Name Signs

Street System Maintenance:
Replace Old Stop Signs

Street System Parking:
Paint Yellow Curb Restrictions

All of the above, except the last four noted projects, could also be submitted for MDOH safety funding and funds may be available by the 1992 construction season.

Project locations which may be funded exclusively by the Department of Highways either through Primary or Secondary system funds or On-system Safety funds would be:

US 93 (First Street) Corridor:
Signing, Curbs and Signal Modifications

US 93 & Riverside Cutoff Road:
Reconstruction, Signing and Markings

US 93 Corridor:
New Signals at State, Pinckney, Pine Streets

Main Street:
New Signals at Second and Third Streets

Improvements to school areas are highly dependant upon work which must be completed within school properties. Only a minimum amount of signing and pavement markings can be upgraded at the school locations without first improving the site access conditions as noted in this report. Negotiations with the school district should begin to develop plans to make improvements at the following project sites:

Hamilton High School:
Street Closure, Signing and Pavement Markings Critical for Accident Experience

Westview Junior High:
Lot Reconstruction, Sidewalks, and Signing Necessary to Eliminate Potentially Hazardous Conditions

Daly Elementary:
Lot and Access Reconstruction Necessary to Avoid Potentially Critical Situation

In addition to the above noted project sites, the **Citizens State Bank** and the **US Post Office** projects can only be accomplished with full cooperation of the owners. The bank drive-thru facilities require extensive modifications to eliminate traffic conflicts on the street system and the Post Office parking and access conditions cannot continue to function without seriously degrading the safety and efficiency of Main Street. The final solution to these problems depends on a mutually acceptable agreement between all parties involved.